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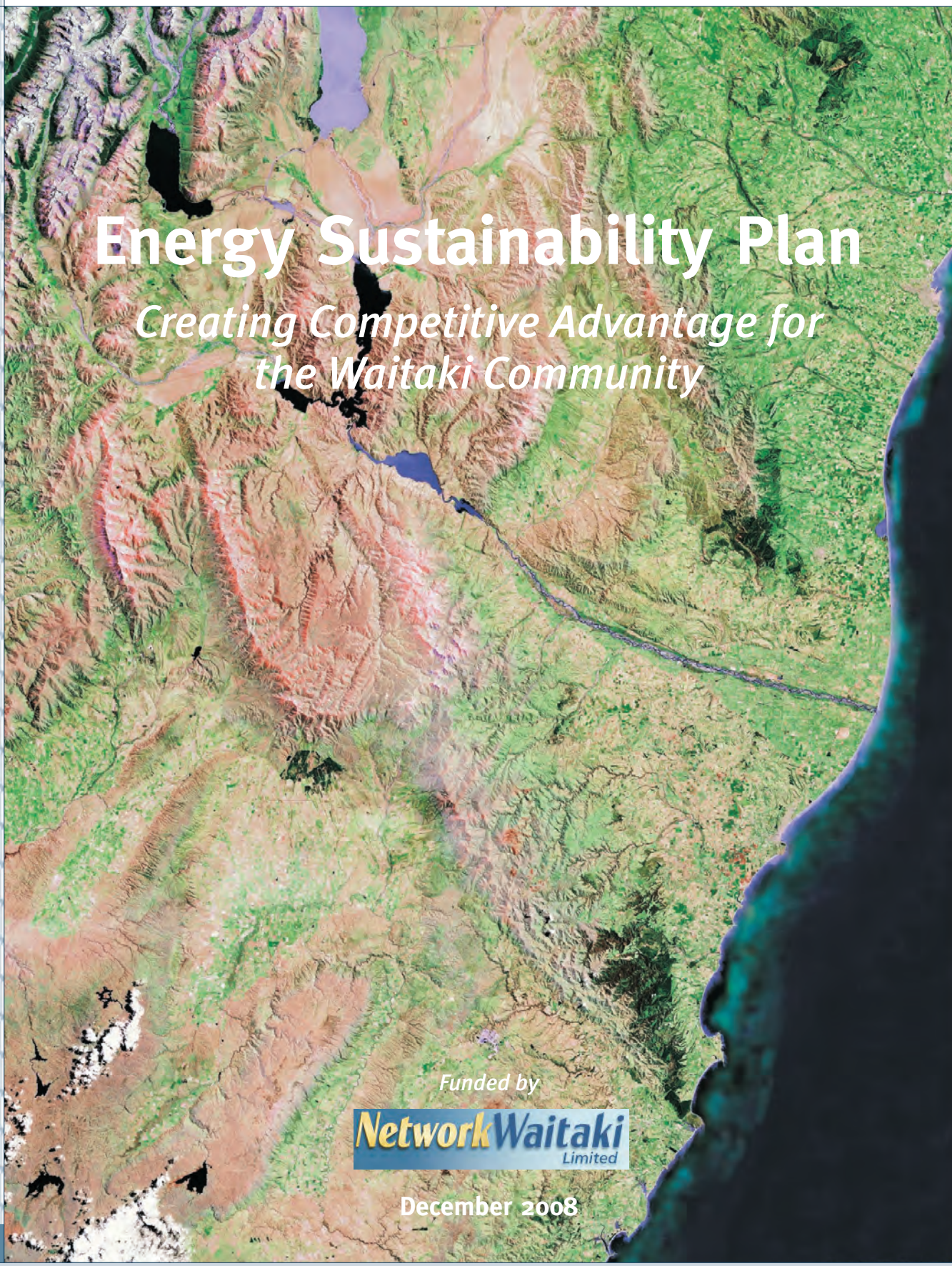

Energy Sustainability Plan

Creating Competitive Advantage for the Waitaki Community

Funded by

Network Waitaki Limited

December 2008

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Report Synopsis:

Providing a platform for the community to engage with local government, in developing more sustainable Economic Development Plans, Infrastructure Development Plans, and their supporting Regional and District Plans, to establish a business environment that maximises the community's ability to create wealth from its local energy resources without compromising environmental sustainability or lifestyle, with specific regard to reducing the impact of global energy issues such as fossil fuel dependence and climate change.

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Approved by:

RJ (George) Hooper

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CAENZ is an independent-think tank and research facilitator funded by grants and sponsorships. CAENZ's mission is to advance social progress and economic growth for New Zealand through broadening national understanding of emerging technologies and facilitating early adoption of advanced technology solutions.

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CONTENTS

1 INTRODUCTION

> *…There is nothing more difficult to arrange, more doubtful of success, more dangerous to carry through than initiating change…The innovator makes enemies of all those who prosper under the old order, and only lukewarm support is forthcoming from those who would prosper under the new.*
>
> Nicolas Machiavelli, *The Prince*, 1513[1]

1.1 Background[2]

The developed world currently faces a problem of its own creation. The cause of this problem is best summarised by the following quote:

> *..we are not only ignorant of what energy is, and the critical role it has played and continues [to play] in economics and politics, but most of us simply don't care about energy.* [3]

This was Paul Roberts' description of the American population's attitude to energy, but is equally relevant to all developed economies.

Energy is fundamental to our economy and our everyday lives, yet the extent of our dependence has been largely overlooked until very recently. In New Zealand, we have benefited from decades of cheap oil, exceedingly cheap natural gas, and an 'apparent' unfettered supply of all consumer energy types (e.g. electricity and transport fuels). For many years as a nation we ignored the inevitability of depletion of current energy stocks without new investment in either exploration or generation. We lost sight of the simple fact that as our demand for energy increased, we would reach a point in terms of the service life of our aging transmission and distribution networks that our energy supply would be placed at risk. We assumed that economic development was reliant on increasing energy supplies, and put little effort into using energy more efficiently.

The sense of outrage and lack of confidence that now pervades consumer attitudes toward the energy industry, as a result of oil price rises and the dry year risk to our electricity system, could simply be described as the manifestation of a socially constructed problem. On top of this there is also public interest and concern in respect of the ongoing use of fossil fuels and the resultant enhanced greenhouse gas emissions to the atmosphere. The issues go further than just energy. Peet and others[4] have argued that we will not address the heart of the energy problem unless due recognition is placed on the resource and ecological constraints of the systems in which we live.

The scale and seriousness of the problem is now evident. Major changes are needed in both the demand and supply side of New Zealand's energy system. The issue is one of transformation, a need for a new approach. To be effective, these new directions will need to be implemented at regional and district levels. The government has introduced a number of policy documents that signal a very different approach to energy in New Zealand at a national level, but many energy-related activities are strongly influenced by the politics, plans and initiatives administered at a local government level.

1.2 Waitaki District's Role

This report was commissioned by Network Waitaki Ltd, the local electricity distribution line company, which is 100% owned by the community's electricity consumers. It is a response to community-driven initiatives with regard to energy sustainability and the need for infrastructure investment being driven by economic growth and change in land use.

It is intended to provide a platform for the

1 www.agassessment.org/docs/ESAP_SDM_220408_Final.pdf.

2 This section draws heavily from a presentation given by Mike O'Connell (ECAN) and George Hooper (CAENZ) given at the EEA Annual Conference 2006, entitled *Energy into the Future: Creating a long-term balance between energy planning and desired community outcomes*. [From the ECAN publication *Identifying the Linkages between Energy Policy and other ECAN Policy Portfolios* - June 2008].

3 Roberts, P, 2004. *The end of Oil: on the edge of a perilous new world*, Houghton Mifflin Company, Boston, MA.

4 Peet, J, 2005. "Sustainable Energy: is sustainable attainable?", *Future Times*, Vol.2, 6-9.

Figure 1: Map of the Waitaki District

community to engage with local government, in developing more sustainable Economic Development Plans, Infrastructure Development Plans, and their supporting Regional and District Plans. These would be used to establish a business environment that maximises the community's ability to create wealth from its local energy resources without compromising environmental sustainability or lifestyle, with specific regard to reducing the impact of global energy issues such as fossil fuel dependence and climate change.

It should be noted that in this report 'community' has a Network Waitaki perspective and therefore refers to the area serviced by its network. This area does not align with the District boundaries and so neighbouring areas (and their infrastructure providers) are included, particularly where there are common interest and interface issues. For simplicity the Waitaki District and its council will be referred to as representative of the community.

This document addresses energy issues and planning in more detail than the District Plan with the aim of achieving an updated set of objectives, policies and rules to support their implementation. The *Waitaki District Council Plan Part II: District Wide Issues, Objectives and Policies: Energy, July 2004* is reproduced in the Appendix (Chapter 8).

1.3 New Zealand's Position from a Global Perspective

The Waitaki plays a significant role in the national energy supply. Its development has always been greatly influenced by national needs, which in turn are driven by international issues. Consideration of global energy issues therefore provides the reference frame for what trends and technology we might expect to see in New Zealand.

These matters are of great interest to the National Grid Operator, Transpower, who are currently conducting an scenario planning exercise for the purpose of updating their long term Grid Development Strategy, Transmission 2040. The following information has been extracted from their consultation material.

In some respects Transpower's document is an indication that issues like global warming and peak oil have now become mainstreamed into Government and institutional thinking. Four future scenarios of the future have been developed to test our sensitivity to issues and the robustness of energy supply development plans.

Scenario 1 – New Norway

The global scene

An international agreement on combating Climate Change is made. An ambitious goal is set – stabilisation at 450 ppm (parts per million) concentration of CO_2 in the atmosphere. National and regional emissions trading schemes are linked and, over time, one global market for carbon is established.

Increased unrest in the Middle East, plus the cost of carbon, makes energy prices soar and with that inflation. That increases cost of oil substitutes further. The world economy keeps a reasonable growth driven by China and India. As a result, the oil price is high. With many countries shifting from coal to gas to reduce emissions, demand for gas is high – especially if sourced outside the Middle East. As a result, the LNG price follows the oil price all the way up to the new level.

The local scene

The first decade of the new millennium ends with a big prize for New Zealand. At first, a medium-sized gas field is found near Taranaki keeping supply secured well into the 2020s. Then, in early 2010, a large oil and gas field off the coast of the South Island is discovered. The evaluation of the discovery takes a couple of years. Apart from a significant amount of oil, there is more gas than in the Maui gas field when found. In 2018, the first export shipment of LNG is made to the Chinese market.

The economy is booming due to the discovery of hydrocarbons and immigration increases. More arrive as climate change refugees find living in their former countries becoming unbearable. To limit the demand growth in the booming economy, environmental taxes are introduced. Still, demand is growing fast, fuelled by a major transformation of the transport sector to electric vehicles.

Demand is met by generation placed where most economic – typically larger renewable installations, including marine energy. As a spin-off from the offshore industry, New Zealand is established as a world leader in harnessing wave energy.

Scenario 2 – Crisis recalled

The global scene

After a turbulent time in 2005-2012, oil prices stabilize in a new price band around UD$55-65/bbl assisted, in part, by technological improvements in extracting oil from unconventional sources. LNG prices are similarly low.

The cost of carbon is close to zero as a disruptive technology innovation that cheaply removes carbon from the atmosphere. (It could also be seen as a scenario where due to a lack of international agreement on climate change, no country is taking significant action, or a scenario where it turns out climate change is not happening).

Large and timely investments in mineral exploration and extraction keep inflation down. As a result of this, the lower oil price and the limited carbon cost, the global economy is growing. Every year 100 million people worldwide are entering the middle class, demanding, amongst other things, more food.

The local scene

The global demand for dairy products, meat and fish is a major driver for the New Zealand economy.

Tourism is also doing well. In comparison with the rest of the world, New Zealand is not outperforming, so immigration levels stay at the historical average.

With little constraints on the use of coal, energy prices are relatively low. As a result of the high GDP growth and low prices, demand is growing at a high rate.

Small micro-cogeneration units become popular, first in commercial settings, but later on in households as well. They supply space and hot water heating and generate electricity as well.

Typically a Stirling engine is used, but later on fuel cells capable of running on reticulated natural gas are taking over as the preferred technology.

Otherwise demand is largely met by thermal power plants built near Auckland and tidal turbines near Auckland and Wellington.

Scenario 3 – Fragmented world

The global scene

Tensions in the Middle East and Russia's quest to return to its former might result in energy security of supply being jeopardised worldwide. With the financial crisis that started back in 2007 still dragging on, most countries try to save themselves rather than cooperate on solving the issues.

The major countries scramble to secure their energy supplies with most prospective oil and LNG projects being taken by high-bidding countries sometimes backed with military threats.

The global economy is growing slowly – hampered by the import tax barriers being set up to protect national industry in many countries. As a result, oil demand is not growing as fast – and supply can keep up with demand. Carbon costs are moderate – with little international agreement on doing anything serious though it is clear that the climate is changing rapidly. Radical environmentalists start attacking oil and gas installations worldwide – including shipping of oil and LNG.

The local scene

Enough natural gas is found to meet local demand though the price closely matches the international LNG price. Methanex decides to close down its operations in New Zealand for good and as a result there is extra gas available for electricity generation. This is used by CCGTs in Taranaki with the CO_2 being extracted and stored in the oil gas fields of offshore Taranaki. Building a LNG terminal is considered uneconomic with the lack of LNG available for longer term contracts.

A new set of "Think Big" projects are initiated to assist the economy and increase the security of supply. The projects include major hydro developments along the Clutha river and utilisation of the South Island lignite reserve.

Scenario 4 – Green communities

The global scene

If weather was considered extreme in the beginning of the millennium, it got even worse in the second decade. Clear signs of positive feedback (self-accelerating climate change) were the driver behind an international agreement of stabilising the level of CO_2 in the atmosphere at 450 ppm.

LNG becomes popular in countries that traditionally had used coal for power generation as switching to gas was among the cheapest ways of reducing emissions. Biofuels from sea algae becomes an important source for transport fuels and results in a rather low penetration of electric vehicles.

The local scene

The New Zealand economy is taking a hit due to continuing global consumer concern over 'food miles'. Tourism also drops as international airlines start to bear the cost of carbon emissions as well.

GDP growth is lower than the OECD average and immigration numbers are only kept up by climate change refugees, which see New Zealand as one of the last places to be severely affected by climate change.

No LNG terminal is built, partly due to local opposition dragging out the resource consent lodged in 2009, but also because of LNG prices in combination with the carbon price would make it uneconomic. Instead, New Zealand embarks on a road of conservation and local generation, the latter assisted by the price of solar photovoltaic panels coming down rapidly.

An observation on the above scenarios is that Scenarios 1 and 2 are optimistically relying on hope, i.e. we will be saved by a new energy discovery or technology will solve our problems. Scenarios 3 and 4 are not only more probable based on today's position, but their consequences are more of an issue for those planning risk management in more adverse conditions. They necessarily will require the biggest change to the status quo.

The actualisation of one planning scenario verses another is affected by the critical uncertainties associated with their drivers.

Transpower has identified the following critical uncertainities:

- **International Fuel Price.** New Zealand is quite dependent on imported fuel and is therefore exposed to pricing risk as it competes for supply. Interestingly, security of supply is not considered critical even though we have just faced a dry year. In a dry year it is the pricing risk that is the dominant issue and not the direct lack of water or generation (the rivers have never stopped flowing and the lights have not been switched off as they were in the 1950s).

  Also of interest is that energy demand is not considered a critical uncertainty. There is no shortage of energy supply options (as long as the sun shines) and the main issue is which option is the next least cost for meeting demand in terms of the costs we choose to recognise. In the absence of other costs like carbon and climate change considerations, New Zealand has had plenty of options for meeting electricity demand without the need to consider efficiency and any conservation options, i.e. decisions have been confined to what large generation and transmission projects will be built, where and when.

- **Cost of Carbon**. In New Zealand the long run marginal cost of new generation is so close between different types of technologies, that even moderate changes in fuel or carbon costs can change the technology most economic to build. The role of gas in our energy supply system effectively means that New Zealand is a low carbon economy relative to others with a high dependence on coal. Europe for example has been migrating from coal to gas for some time now.

- **Government Energy Policy**. Clearly a direct intervention with a proven track record of being a wild card as governments are changed and respond to public opinion.

- **Climate Change**. New Zealand being an export-based economy remote from its markets is sensitive to its customer's attitude towards such issues.

- **New Technology**. This is a cost stack issue, i.e. not whether there are new technologies, but which ones will prove to be the most cost effective, developed the quickest, and adopted by the trend setting economies.

- **Resource Planning Requirements (RMA).** The RMA in many ways is a hurdle to the large-scale core infrastructure developments of the past, which clearly aren't going to meet sustainability into the future. It acts to change the cost stack in favour of smaller, more incremental and localised developments. New Zealand infrastructure providers have been slow to adapt to the legislation resulting in infrastructure getting older and being driven harder. The required change is resisted by those with large investments locked into the status quo, i.e. new more efficient technology as measured by new cost/sustainability considerations are competitors to their existing business and devalue their investments.

  One could argue that the uncertainty created by the RMA is that while these investors continue to push proposals that don't meet expectations on environmental and sustainability issues, the alternatives are not forthcoming because they are not able to compete on an equal basis.

Transpower's document also identifies urbanisation, NIMBY'ism (not in my backyard), and global warming as global trends likely to be 'imported' into New Zealand. With regards to this plan it is noted that city-dominated politics and national perspective diverges with provincial communities on some of these issues.

2 ENERGY IN THE WAITAKI

2.1 Waitaki District Statistics at the 2006 Census

- Usually Resident Population: 20,223
- Land Area: 7,214 km²
- People per km²: 2.8 (All NZ: 9.7)
- Age Profile: 18.9% were under the age of 15 years (All NZ: 21.5%).
  20.0% were aged 65 years and over (All NZ: 12.3%).
- Unemployment rate: 1.9% (All NZ: 3.4%).
- Occupational group: The most popular occupational group was Agriculture, Forestry and Fishing. (All NZ: Manufacturing).
- Median income: $19,700 (All NZ: $24,400).

Income ($)	Waitaki District	New Zealand
5,000 or less	9.5%	12.1%
5,001 - 10,000	8.3%	7.2%
10,001 - 20,000	28.7%	19.5%
20,001 - 30,000	15.3%	13.8%
30,001 - 50,000	20.3%	21.1%
50,001 or more	9.6%	16.2%
Not Stated	8.2%	10.2%

Households: There were 8,433 households in Waitaki District Council.

- The average size was 2.4 people (All NZ: 2.8).
- 89.3% had access to a telephone (All NZ: 87.8%).
- 68.9% had access to a cellphone (All NZ: 71.1%).
- 50.2% had access to an internet (All NZ: 58.0%).
- 89.3% had access to a motor vehicle (All NZ: 88.1%).

Dwellings

- For rented dwellings, the average weekly rent paid for permanent private dwellings was $140. (All NZ: $225).
- 75.9% of dwellings were owned with or without a mortgage. (All NZ: 68.9%).

2.2 Economic Performance 1997-2007[1]

In 2007, the Waitaki District had almost 8,700 full-time equivalent employees (FTEs) in 2800 businesses generating $753 million in gross domestic product (GDP).

Table 2.1 breaks down FTEs, GDP and business units in Waitaki District by sector for the year to March 2007.

The District performed well in terms of most key performance indicators during the latest year. The District is in the midst of structural changes, particularly in the primary sector, with significant conversions from sheep to dairy farming. Over the ten years since 1997, the economic performance of the District has been more mixed. Per capita GDP and labour productivity growth have outshone the national average, but a slow decline in population numbers has hampered overall employment and, therefore, GDP increases.

GDP per capita and labour productivity provide a better picture of the overall rise in economic prosperity of the people of the District. GPD per capita has risen 2.0% per annum over the last ten years in Waitaki, above the national average, led by retail and distribution, and manufacturing and building, and the primary sector.

Business unit numbers have climbed in all sectors except primary in the last decade. By far the most impressive rise has been in the business services sector, where the number of units doubled, averaging 7.6% per annum.

[1] Report to Waitaki Development Board: David Norman & Dr Garnesh Nana. *Waitaki District Economic Performance 1997-2007*, April 2007. BERL ref#4653.

Sectors (2007)	FTEs	%	GDP (07$m)	%	Business units	%
Primary	1900	21.9	158	20.9	1082	38.3
Manufacturing & Building	2633	30.4	254	33.8	322	11.4
Retail & Distribution	1956	22.6	110	14.6	497	16.9
Business Services	660	7.6	146	19.4	662	23.4
Recreation Services	301	3.5	15	2.0	144	5.1
Social Services	1217	14.0	70	9.2	138	4.9
Totals	8666	100.0	753	100.0	2827	100.0

Source: BERL Regional Database, Statistics NZ

Table 2.1: Composition of Waitaki District economy in 2007

Tourism continues to develop in the District, contributing $31.3 million in direct GDP, employing 540 people and supporting the equivalent of 160 businesses. While tourism-characteristic industries account for most tourism employment and businesses, a wider range of industries account for noteworthy portions of tourism GDP.

The move toward dairy accelerated in 2007. Six new herds and an additional 6000 cows were added to the industry in Waitaki, and the total now stands at 57,000 cows on 19,066 ha. Conversely, sheep numbers were largely flat at 891,000. The drop in sheep farming employment in the last ten years has been matched by the rise in dairy employment.

In conclusion, growth in the primary sector is limited by the fact that dairying is displacing existing sheep farming and is just an economic efficiency issue in terms of existing commodity prices.

2.3 Local Economy Commentary

The Waitaki District Economic Performance Reports commissioned by the Waitaki Development Board indicate that over the last 10 years growth in GDP for the District (2%) has been slightly higher than the national average of 1.8% p.a.

In the *primary sector* - 'Agriculture, Forestry and Fishing' and 'Mining' - this is largely the result of higher productivity driven by a shift towards production of higher value commodities, i.e. dairy displacing grain and sheep. In the long-term it can be expected that relative positions will cycle. Commodities values in total have consistently trended down over the long term so the primary sector can continue to expect to be on a tread mill of having to increase productivity just to remain competitive. Overall the number of business units in the primary sector has declined, i.e. fewer are producing more.

The *secondary sector* – 'Manufacturing', 'Electricity, Gas and Water Supply' and 'Construction' – remains the back bone of the local economy. Irrigation and farm development, cement making, food processing (meat, grain, and dairy) are secondary sector businesses. This sector represents the district's main employment and population dependence. Economic Development strategies would therefore be expected to develop new opportunities in this sector and protect the existing businesses. In order to maximise retention of benefits locally, local ownership and entrepreneurship needs to be considered.

Some diversity in this sector would reduce risks to the local economic situation. Establishing the district as a manufacturing-friendly location would allow the area to play to its strengths relative to cities, e.g. stable, quality workforce, low-cost sites, location on main transportation infrastructures, proximity to resources, energy, water and utility services.

The *tertiary sector* – 'Wholesale Trade', 'Retail Trade', 'Accommodation, Cafes and Restaurants', 'Transport and Storage', 'Communication Services', 'Finance and Insurance', 'Education', 'Property and Business Services', 'Government Administration and Defence', 'Health and Community Services', 'Cultural and Recreational

Figure 2.1: Territorial boundaries for the South Island of New Zealand

Services' and 'Personal and Other Services' – shows the greatest development by far. This is essentially growth in tourism and recreational-based businesses. Service industries are characterised by high employment, low capital requirements, small locally owned/operated businesses and demand for a wide range of supporting services.

Business services centred on pure commerce activity displays the weakest growth performance. Clearly the Waitaki is not a centre of

international commerce. It does, however, have the capacity for supporting technology-based businesses such as call centres.

2.4 District Economic Powerhouses

The District's strengths/opportunities are dominated by food production and secondary sector processing of the local primary production. This sector creates its competitive niche by targeting the right combination of quality and value adding to its primary products. It is a relatively high employment sector. The main industries and opportunities are listed below:

- **Meat processing**: Oamaru's largest employer is the Alliance Pukeuri Freezing Works. It is the second largest consumer of electricity and currently the largest energy consumer when its coal consumption is also considered. Oamaru is the birthplace of frozen meat exports. The Pukeuri Works has a killing capacity of approximately 14,000 sheep per day and its season now extends over 10 months. There is also another smaller abattoir business in town. These businesses are counted in the most productive meat processing facilities in the world. Their survival has always been linked to a secure supply of animals and product development to get the right level of value added content.
- **Dairy processing**: This industry has also had long-term presence in the district with numerous creameries, butter factories and dairy processing facilities. These businesses have come and gone with the fortunes of the dairy industry as a whole. A significant cheese making business has been established on the basis of differentiating itself as a local, high-quality product. An important sustainability issue that the District faces with dairy development is the need to maintain and increase diversity, avoiding market uncertainties and the risk of damaging existing key employers. Growth in dairy does not represent a high lift in productivity because it is largely based on displacing existing production of another kind.

  The newly developed diary factory at Studholme is largest single energy consumer and employer in the Waimate District on the north side of the Waitaki River. This facility is planning to grow significantly.
- **Small goods** such as bacon, sausage making, etc., are secondary businesses that can lever off the presence of the larger processing facilities and have a similar opportunity to benefit from the North Otago food quality brand. The loss of the Mainland bacon factory was more of an issue of loss of local controlling interests than profitability.
- **Organic produce**: North Otago is ideally suited to this industry in that it has highly productive quality soils and a climate not conducive to pests and disease. It could develop organics as a point of difference that supports its reputation for food quality.
- **Greenhouse grown produce**: market gardening has been established in North Otago since the arrival of the original Chinese migrants. The area is well known, specifically for potato and tomato growing. Greenhouse production extends the growing season (and therefore business viability) and maintenance of capacity and production needs these facilities to modernise.
- **Grain**: North Otago has some of the highest per hectare yields for barley and oat cropping land in the world. Grain growing is the earliest established local export. The area is well endowed with mills, grain stores, malting floors, etc. Milligan's operates the historic Ngapara Mill. Quality Bakers has a large bakery in Oamaru now dedicated to pie making. Surprisingly, New Zealand imports most of its own locally used grains for beer brewing, bread making, etc. This is especially the case for organic grains. The current issues with regard to food safety, food miles, and the cost of importing will eventually lead to a shift back to local production.
- **Grapes:** This is new development for the Waitaki Valley with approximately 2000 ha now planted. Climate and soil conditions mean that this industry has a large potential in the district. This will drive irrigation development, and eventually local grape crushing, processing and storage facilities will be needed. North Otago can equally support brewing and distilling activity.
- **Wool products:** The Summit Alliance Woollen Mills is Oamaru's second largest employer and third largest consumer of

electricity. It also uses coal-fired boilers for its main source of thermal energy meeting its processing requirements. It is another long-established business in town that survived where others have failed elsewhere in New Zealand. Its survival and development will be dependent on choosing the right niche for quality and value adding so as not to have to compete directly on volume.

- **Quarrying**: With extensive resources in lime, gold, coal, aggregates, roading materials, and various minerals the Waitaki District has always had a higher than average level of this activity. Quarrying and mining activity accounts for about 4% of its employment.
- **Lime, cement, and concrete making**: Concrete has been the number one choice of building material for over 2000 years. Cement making is an obvious opportunity for a location with extensive deposits of all the key raw materials. This includes concrete products such as pipes, troughs, etc. Firths, Hynds, and Waiareka Industries have pre-casting businesses in the district. A recent economic study has shown the importance of the concrete industry which contributes about $7.44 billion to New Zealand's economy. (Source: *Grey Matters* Issue 66.)

  The proposed Holcim Cement Plant will be the biggest energy user in the district with a 15 MW demand and an 80 GWh pa electricity consumption in addition to coal and waste oil burning.
- **Foundry**: Heavy industry in Oamaru is also represented by a foundry. This uses electric arc furnaces, and has a number of issues to address in terms of emissions, efficiency, etc. It produces water valves and pumps and so has a local niche in terms of irrigation and infrastructure development.
- **Fertilizer making**: Sequestering CO_2 and finding alternative forms of carbon to fossil fuels is a global trend in terms of climate change. Carbon trading schemes will reward innovation and create opportunities. In addition to raw products like limestone, CO_2 as a waste product, can be used as a carbon feed stock for fertilizer manufacturing as can nitrogen from other waste products or extraction from the air. Oil, oil products, and fertilizer make up approximately one third of New Zealand's imports.
- **Animal feeds**: Highly productive, irrigated land can be dedicated to growing animal feed. Animals can then be farmed at less productive sites with the net effect being more intensive production. Waste products from industry can be used to compost/fertilize (add carbon to soil) and for animal feed more directly (tallow, whey, other dairy products, etc).
- **Fishing and Fish Farming**. With such a significant coastline and maritime resources fishing is clearly a major economic activity. However, as very little of this is owned and operated by local interests, not much value is captured by the local economy. Neither are there any significant processing facilities. Fleet servicing facilities are also limited.

  Salmon farming has been established in the region utilising the canal and lake system of the Waitaki Hydro-electric Generation Scheme and has potential for further development.
- **Other**: Other sizable production facilities include the Rainbow Confectionary factory. Off-shore oil and gas reserves are approaching viability for bringing ashore and into production.

The Waitaki District also has infrastructures and capacity in the following areas of economic activity:

- **Technology businesses:** Local businesses include an electronics manufacturer and a call centre for TrustPower. To run a call centre requires access to communications infrastructure, local IT support services, and a large flexible workforce with appropriate skills.
- **Education:** The District is also well endowed with quality education facilities, including three high schools with boarding facilities and a polytechnic campus. The polytechnic is part of the Timaru-based Aoraki Polytechnic and therefore competing with the Otago Polytechnic. Oamaru is located only 120km away from the Universitity of Otago. Oamaru already provides significant education services to external markets. Invercargill has established a significant economic gain for Southland via a low fees scheme at its polytechnic. The biggest issue with meeting local needs with respect to education is retaining young educated people locally

once they enter the workforce. They need suitable choice and opportunity to develop a career in their chosen field. More diversity in the number of businesses with local management roles is needed.

- **Health and old age care:** Oamaru has a new well-equipped hospital, which includes a scanner. Larger hospitals are located in Timaru and Dunedin. There are several large rest homes with residential healthcare facilities incorporated. Oamaru is well suited to an older population with flat streetscapes, good civic facilities and shopping, all within walking distance, and low traffic densities. With an aging population, continued development of retirement villages and suitable new housing stock is likely to remain a strong opportunity. This type of housing stock has specific energy supply requirements, e.g. homes are likely to be all electric.
- **Tourism industry:** There is significant tourism potential in the region and the area has already established a brand in eco and heritage tourism for which it has a major inventory of assets outstanding in terms of quality and significance. Oamaru can develop into a visitor destination in its own right if it were to invest in some cornerstone attractions and interpretive facilities. This is a relatively low-cost economic development option because the core asset on which these facilities can be built already exists. Triggering tourism in this way will lead to private investment in accommodation and hospitality and entertainment businesses. This activity sits in the tertiary economic sector and is labour orientated, i.e. employment intensive and dollar-for-dollar investment generates greater economic wealth. The tourism industry has a high demand for reliable and secure energy supply.

2.5 Local Resources

Geography

The region's geography is described as flat on the numerous river flood plains, rolling downlands between the coast and foothills, and mountainous in the remote backcountry. It is prone to snow, wind storm, flooding, and drought conditions with regular events that would be considered extreme in other locations. Accordingly its infrastructure needs to be strong, resilient, well designed and maintained, as access and response to events can be difficult. Relatively large land area and small population size means that infrastructure is low density and has limited economics.

Transport

Most of the region's population centres and towns are located on the State Highway network. The coastal area is serviced by the rail system which follows SHW 1 and connects Oamaru with international shipping ports at Timaru and Port Chalmers. Oamaru itself has a historic port and Moeraki supports a small fishing fleet. There are airports at Oamaru and Omarama. Snow and flooding can interrupt transport systems.

Water

With good soils and a dry climate, water is the key to land-based production. The Waitaki River is New Zealand's highest flow volume river so water is not a resource that is lacking in this area. However the water is shared with national uses such as generation and is closely watched by neighbouring cities as a potential for supplying their needs. The Waitaki Water Allocation Plan has been implemented to balance competing interests. It remains important for the local economy that it sustains priority use of the resource. There is an optimum mix between managing water use through dry land sustainable management practices and investment in water-distribution infrastructure. It is uncertain where the optimum point will settle in the long term as export markets are unstable with regard to demand, pricing and exchange rate.

There has been major investment in irrigation development in recent years with the North Otago Irrigation Company Black Pt Scheme extending irrigation to 20,000 ha beyond the Waitaki Catchment. There are currently six older boarder-dyke irrigation schemes operating in the Waitaki Valley. Farming intensification is driving a shift to more efficient forms of irrigation.

There is an extensive network of rural water-supply schemes. Limitation of capacity is constraining residential development in rural townships. However, the Oamaru Water Supply system has just been graded to high treatment standards and has sufficient capacity to service

outlying communities. This water is abstracted from the Waitaki River utilising irrigation infrastructure to replace an older gravity-race scheme. It is a possibility to reinstate gravity water supply via upgrade with pipes to create a more energy efficient delivery system.

Any farm-based economy with dry land conditions needs a sustainable Water Management Plan to secure and maximise its future potential. Rainwater and grey waste water remain largely under-utilised resources.

Waste water

Reticulated sewers and treatment plants exist for Oamaru and all rural townships. These facilities are conventional with very little innovation such as reuse or collecting bio-gas. Large facilities tend to have some pre-treatment and waste reduction on site. The Pukeuri works supplements its on-site waste management with a composting operation. There are limited industrial development sites available in close proximity to the Oamaru Sewerage Plant. Farm effluent is subject to management plans.

Solid waste

This is still largely treated as a problem rather than as a resource. No innovation in terms of rubbish burning or gas collection exists. Landfills are constrained and expensive. The district should be able to manage costs to local businesses more effectively than larger competing city economies.

People

The workforce is generally considered to be stable, literate, and low waged.

Missing energy related infrastructures include reticulated gas pipes and reticulated hot-water pipes for community heating schemes.

2.6 Energy use

There is limited information available on energy use patterns within the District and the dependencies that ensue. What is known is that despite significant local resources, all sectors of the community are strongly dependent on electricity for household energy use and liquid fuels for transportation. While electricity is generated in the District, a large percentage of the thermal energy consumed comes from outside the region.

Oil products for transportation and agricultural activity are a critical lifeline for the District. Any threat of disruption to either the electricity grid or the supply of liquid fuels will have a major effect on the communities and their economic resilience.

Domestic space heating is an important concern with its effects on health, comfort and air quality in many areas. In order to better understand the vulnerability of the District to disruption of its energy services it is necessary to look at the issue from a total system perspective and to understand the interrelationships between the individual supply chains that make up the total system.

In the Waitaki District the important supply chains present are:

- electricity;
- coal;
- wood;
- LPG; and
- transport fuels.

This report takes a first look at the delivery of these services, and their contribution to the Waitaki District energy system. Information is given on the current supply situation and comment provided on the potential contributions for the future. A majority of the information presented here is from the public domain.

From this commentary vulnerabilities have been highlighted and potential risks to supply exposed. In addition, the interrelations between the supply chains are investigated, particularly where these may cause interruption of supply. With the resources available to the study it has not been possible to quantify the likely risk outcomes in a formal way. Instead, our aim has been to inform and advise on future district action to mitigate identified vulnerabilities.

2.6.1 Energy changes

Energy changes over the past 20 years (1986 to 2006) and the fractions of types of energy that are unlikely to be greatly different in the Waitaki District compared with those published

for Christchurch City are:

- An annual average growth of all energy use of approximately 2.5%.
- Oil products dominant at 64% (2006) of all energy use.
- Transport (vehicles) is the biggest user of energy at 33% (2006) of total energy.
- Electricity use rises steadily but maintains its market share at around 25%.
- 79.5% (2006) of all energy used is **non-renewable**.

(http://www.ccc.govt.nz/environment/sustainableenergy/energystrategy.pdf)

However there are other areas that are expected to be significantly different in Waitaki compared with Christchurch:

- Despite a slowing down of the trend in recent years Waitaki has a reducing population dropping 0.3% in the past 11 years, compared with Christchurch which is growing approximately 1% per annum. A more significant trend for the district is that its population is aging.
- The airport at Oamaru is a small operation so, although increasing from zero to a return flight every day, it is still not significant in terms of energy consumption growth. The planes that fly in and out of Oamaru are currently fuelled at Christchurch.
- Oamaru's gas works have been closed for several decades. The housing stock at the time had to adapt to another energy source. This was typically electricity for water heating and solid fuel burners for space heating. These appliances are now at the tail end of their life expectancy.
- LPG use in Waitaki is unknown but anecdotally capturing a growing market share. There are no reticulated subdivisions like Queenstown and Christchurch, but an effective bottle distribution service exists. LPG appliances are often a first choice by property developers because they have lower capital costs and no network connection fees. LPG market share exceeds 5% in Christchurch.
- Coal use in Waitaki is predicted to significantly increase for cement production. The lignite coal is to be open cast quarried from a deposit located in Ngapara transported approximately 15km to the cement plant at Weston. Up to 210,000 tonnes per annum will be quarried for approximately 30 years. In most industrial processes in the Waitaki, thermal load represents the biggest use of energy and this is typically provided by coal burning boilers supplemented with electric heating to allow boiler turn-down. Coal is still a significant residential heating fuel in the older housing as the local foundry previously manufactured a range of solid-fuel (wood/coal multi-fuel) burners and these are still in common usage.
- Firewood remains an important residential fuel in Waitaki and until recently there was little formal concern with air pollution in Oamaru, but smoke from choked off log burners is causing high pollution conditions during thermal inversions.
- In Christchurch wood pellets are the only part of the 'wood' fuel type that is showing a steady growth. Pellets are relatively expensive in Waitaki compared with the readily available waste timber from local sawmills and firewood merchants. Pellets are, however, a clean convenient option for the older population who prefer the ambience of a living flame.
- In Christchurch CO_2 emissions have risen dramatically over the last 20 years to reach 3.27 million tonnes in 2006 compared with 1.55 million tonnes in 1986. The ORC website reports that there have been 3 high pollution days in Oamaru since 1 July 2008 when monitoring equipment was installed, with the highest PM_{10} reading being 53.8 ug/m^3 (above the 50 ugm^3 health standard).

2.6.2 Description of Waitaki's Electricity Supply from a Local Perspective

2.6.2.1 Governance

The national electricity supply is quasi-regulated through Government Policy Statements implemented by the Electricity Commission who are responsible for governance of the industry.

Generation is governed via a set of energy market rules determined by the Electricity Commission. Transmission pricing and investment is governed directly by the Electricity Commission and its governance rules. Line

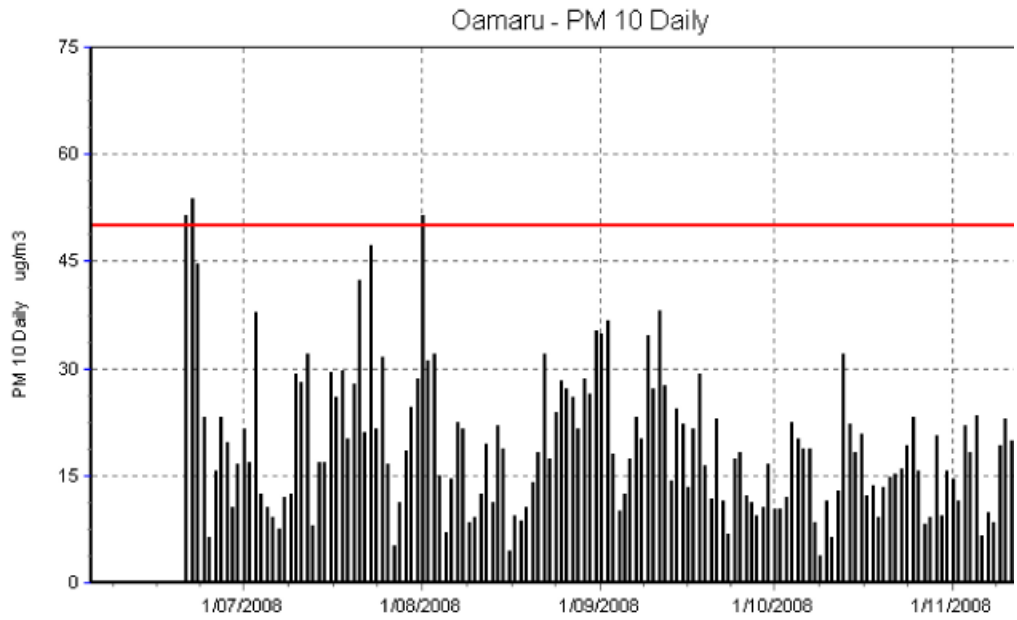

Figure 2.2: The red line shows the 24 hour average PM_{10} health guideline of 50 µg/m³. (Source: http://air.orc.govt.nz/airinfo/showsite.asp?s=154#gif180)

companies are also regulated directly by the MED and Commerce Commission.

Government Policy Statements define the Electricity Commission's objectives with regard to Security of Supply, Transmission upgrade, Reserve Generation, renewables, and energy efficiency.

An issue of local concern is that the electricity system is operated to national objectives rather than optimal local conditions. Applying local resources to overcome a national security issue, for example, may not be the best outcome for South Island electricity users and/or Lower South Island users. South Island spot prices can be higher than the North Island if the South Island hydro lakes are run low to maintain security in the North Island. This situation can become pronounced if the national security risk has since past, but the South Island remains dry.

When such conditions require energy to be transported south from the Waitaki Valley into Otago/Southland, local line companies are put under pressure to compromise their security (in terms of grid configuration) to allow maximum transfer south. Water management is a competitive issue between generators/retailers whereas transmission security is a contracted service. Local security should not be compromised to compensate for generator's risk-taking.

Ideally market minimum operating zones should be applied on a regional or island basis. This may smooth out volatility in the supply price risk.

Distributed generation (DG) and demand-side management (DSM) tend to sit outside market structures and therefore are not yet mainstream solutions. There are practically no significant DG or DSM initiatives in the Waitaki District.

2.6.2.2 Generation

The Waitaki Catchment is home to the eight hydro-electric power stations (1300 MW of installed capacity) of the Meridian Energy owned Waitaki Power Scheme, which generates approximately 14% (6,000 GWh) of the national electricity production (42,000 GWh). Fifty-five per cent of New Zealand's electricity is generated from hydro power schemes so the Waitaki generation represents 26% of all hydro energy produced nationally (Energy Data File).

All of this generation is grid connected and owned by the Government through its SOE, Meridian Energy Ltd. The water resource has been taken from the local community in the interests of national benefit. That is, there is no mitigation paid to the local community for the use of its local resources. In a private commercial development scenario, it would be

reasonable for the community to expect a greater share of the benefits for the use of their resources (consider Holcim's recent consent for example).

While representing 60% of the nation's hydro storage, the Waitaki Scheme is essentially designed and operated as a 'run of the river' hydro-electric generation scheme. Its storage allows water to be managed in a half-hourly spot market on a weekly and daily basis rather than for seasonal peaking.

Meridian manages the water on the basis of best commercial advantage in the competitive energy market rather than to national security objectives (which are responsibility of the Electricity Commission). Local position does not feature in these considerations. In times of constraint the local supply is subject to national issues and responses can be to local disadvantage.

Apart from lack of storage, there are issues with provision of spinning reserve, lack of backup generation, lack of diversity, and remoteness of load. These issues challenge the use of water for generation as the most economically efficient application of the resource.

Continued development of large scale grid-connected generation is therefore challenged by the RMA and competing local interests. The Electricity Commission's own planning concludes that more commercially attractive options for large-scale hydro development exist on the Clutha River at Luggate, Queensberry, and Tuapeka. This river is less developed than the Waitaki River and therefore has lower cost options.

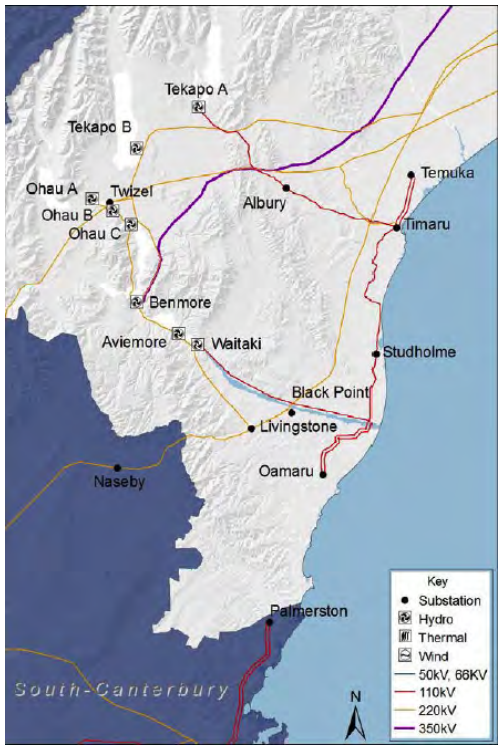

Figure 2.3: South Canterbury/North Otago transmission map (Source: TPNZ Annual Plan 2008)

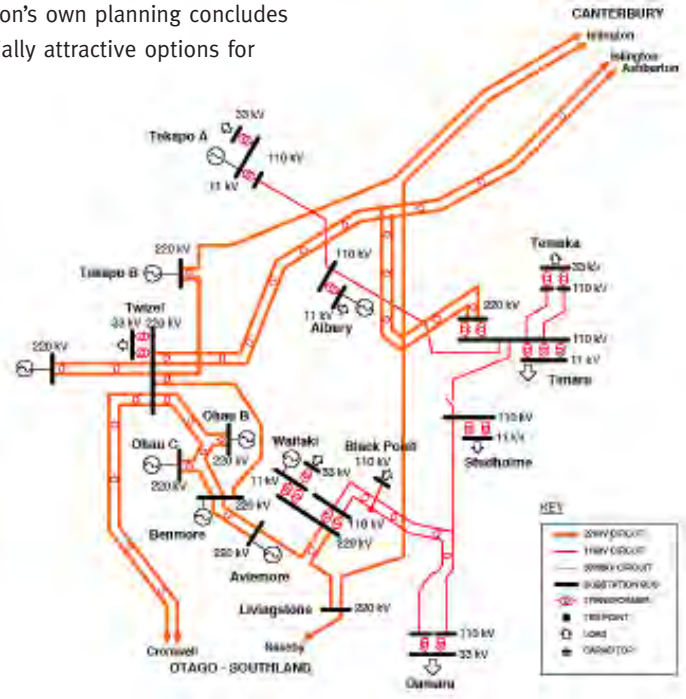

Figure 2.4: South Canterbury/North Otago transmission schematic (Source: TPNZ Annual Plan 2008)

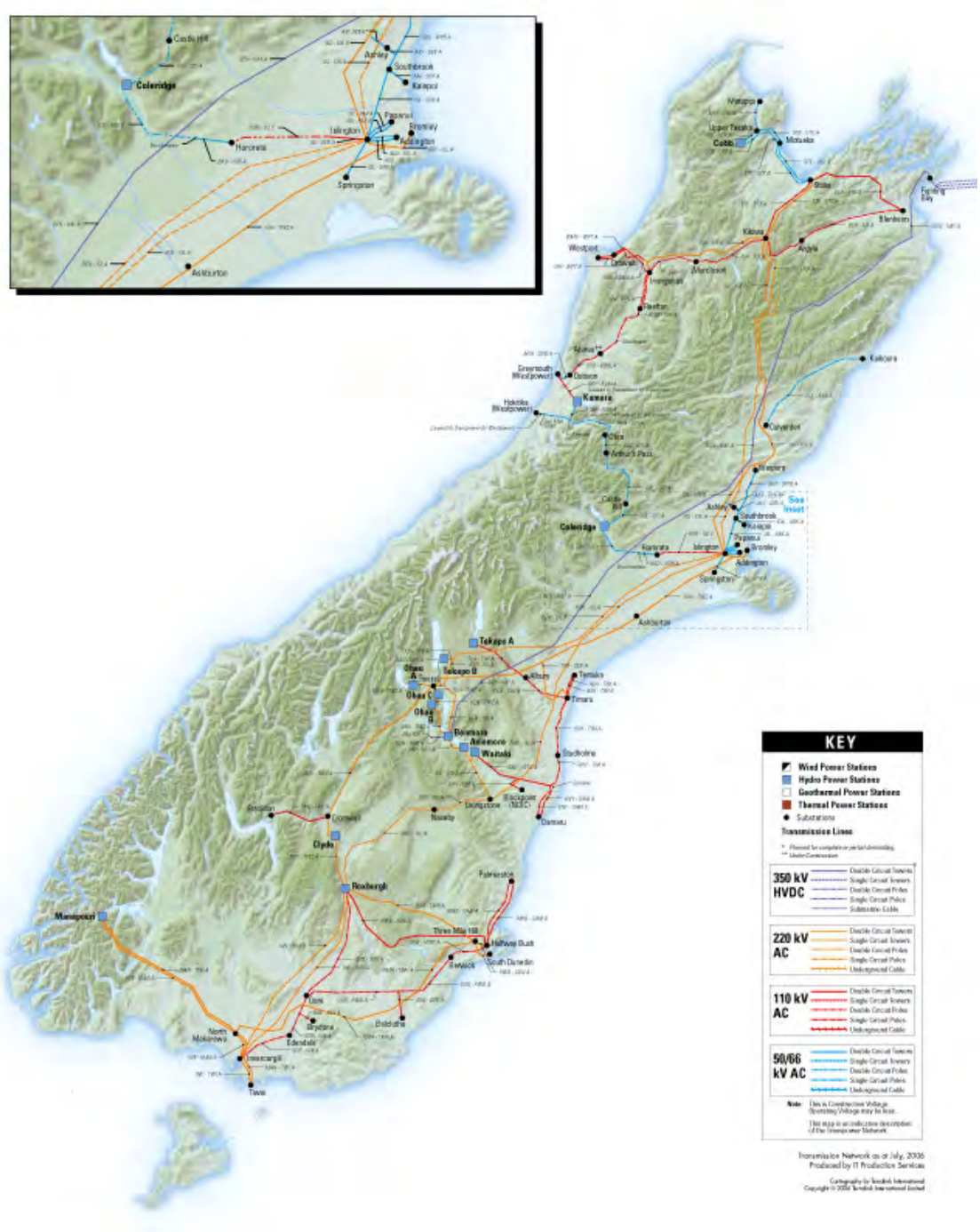

Figure 2.5: South Island transmission map
(Source: www.gridnewzealand.co.nz/f70,3566/3566_transmission-map-si.pdf)

Self-sufficiency in energy generation and decoupling of energy cost from the national market is in Waitaki's advantage given its proximity to and abundance of generation resources.

2.6.2.3 Transmission

Total demand in the Waitaki area amounts to 35 MW (240 GWh) in North Otago and 113 MW (678 GWh) in South Canterbury, which includes Timaru and Temuka (Fonterra). Most of the generation output (85%) is therefore exported from the region.

The South Island transmission grid is centred on Benmore. From the Waitaki Valley energy is sent north to Christchurch via the 220 kV core

grid and to the North Island via the DC Link. It is also possible to send electricity south when low water flow conditions prevail in the Clutha and Manapouri catchments.

Christchurch is serviced by a dual circuit 220 kV tower line from Twizel, a single circuit 220 kV tower line from Naseby over Dansey's Pass (interconnected to the Waitaki Scheme at Livingston), and a single circuit 220 kV line from Twizel (interconnected to the Tekapo B generating station). Twizel is interconnected to Cromwell via a dual 220 kV tower line over the Lindis Pass. All the Waitaki generation stations are interconnected to each other, Twizel, Benmore (DC Link), and Livingstone via a 220 kV tower line.

The Otago/Southland region is also a significant exporter of energy north. Security is its main supply issue because of lack of diversity from hydro generation and hydro storage.

However it should be noted that the probability of low flow conditions existing in Otago/Southland are extremely rare and more likely to be the result of water management prioritising national position with regard to conditions further north. The significant quantity of wind generation being developed in Otago/Southland further reduces the likelihood of the need to transfer energy south.

Any economic storage that can be added to any of the developed hydro schemes would also take priority over further run of the river generation development with its associated requirement for transmission and security provisions.

The development of this generation in Otago is a priority in terms of the NZ Energy Strategy objective for 90% renewables and incidentally in terms of economic merit, i.e. it is more commercially competitive than hydro development on the Waitaki River for example. Consequently transmission development is being investigated to reinforce transmission capacity from Otago into Waitaki.

This shifts the transmission bottleneck north and allows the new generation in Otago to compete with generation in the Waitaki for supplying Christchurch and the North Island. The consequence will be further upgrade of the core grid that the Waitaki area does not use directly.

Any transmission development that targets a benefit for other regions and is not needed locally is an economic penalty to the local economy because average costing of the core transmission grid results in a local cost for which there is no local economic benefit.

Recent security-of-supply issues indicate that the national electricity supply has now developed to a point where there is some dependence on the DC Link for security. When hydro flows are low, North Island thermal plant is dispatched in priority to hydro-generation. This allows transfer south over the DC Link during off-peak periods for the purpose of conserving water.

The DC link does not have n-1 security (especially with pole 1 on limited service) and this risk was recently demonstrated with a single tower threatened by a land slip. The South Island is not secure without its own emergency generation capability.

The DC Link would not have been built under today's rules for transmission investment or on the basis of economic advantage in a competitive market. Its development was for strategic benefit in a different strategic environment. It is not the least cost development, compared with building South Island thermal plant, for hydro and wind firming, peaking, and reserve generation.

It is a possibility for the Waitaki Community to build and own transmission. This option would isolate the region from transmission pricing and the electricity cost path created by servicing load growth in other locations and meeting security standards at national level from which the region does not share benefits.

The local supply does not use the 220 kV core grid. Its loads are much smaller and dispersed than those requiring a 220 kV voltage standard. Accordingly it remains supplied from the remnants of the old 110 kV transmission system of 1930s vintage and has efficiency, quality, and reliability issues associated with driving old equipment hard.

North Otago and South Canterbury are fed from a 110 kV dual circuit tower line from the Waitaki Dam.

Originally this line connected the Waitaki Dam to the 110 kV transmission system that ran up the east coast from Dunedin to Timaru. In 1994 Waitaki Dam was interconnected to the 220 kV core grid and the 110 kV system reconfigured so that Oamaru is supplied on a dual circuit spur from Waitaki. The coastal circuits were removed between Palmerston and Oamaru.

This arrangement has resulted in a decrease in security for Oamaru. The Waitaki - Oamaru lines also support an n-level security Grid Exit Point, GXP, at Stuholme (supplying Waimate and the dairy factory) hard "Tee" connected to one circuit and an n-level security GXP at Black Pt (supplying the NOIC Irrigation) hard "Tee" connected to the other circuit.

The Black Pt connection is unusual in that the GXP is owned by Network Waitaki (not Transpower) and is subject to a Notional Embedding Agreement based on the fact that the transmission system can be bypassed with a lower cost alternative transmission line connected to the generation at the Waitaki Dam. The generation system itself is able to deliver adequate supply and security to local users without the backup of the core grid, i.e. the local supply does not share 100% of the benefits normally associated with core connection.

In terms of load forecasts and the related need for security upgrade the 110 kV system is limited in its development potential. Consideration is now being given to what point a 220 kV connection needs to be developed for local supply.

2.6.2.4 Other issues

Other issues with the current transmission system are:

- The age and reliability of the 220/110 kV interconnection transformers at Waitaki. These are very old, there is no available spare, and one unit is gassing, indicating an internal fault. These transformers are charged for on the basis of modern equivalent assets.
- There is no voltage control equipment or 110 kV bus at Waitaki. The voltage stability on the Waitaki 220 kV bus is not good because of the station's role as the slack bus (frequency control) in the operating regime of the core grid.
- Neither Black Pt or Studholme have suitable configurations in terms of security to meet the requirements of the loads they now serve or ideally be developed for.
- The lines are constrained by their thermal rating and there is an economic limitation as to how much load can be supported over the distances involved at 110 kV via a strategy of increasing conductor size.
- The out-of-balance at Oamaru GXP caused by different loadings at Black Pt and Studholme result in degraded available capacity at Oamaru. 110 kV bussing and/or capacitors are needed to improve voltage correction.
- Transformers at Oamaru will need to be upgraded in the medium term to meet forecast load.
- The cost, consenting and investment approval process (Grid Investment Test) make the establishment of new GXPs uneconomic.
- There is no grid exit point between Waitaki and Twizel. Capacity is therefore constrained by distance. The transformer at the Waitaki GXP is connected to the generation and currently capacity is constrained such that during peak loading, load must be shifted off Waitaki and onto Twizel. This incurs duplicated transmission charges.
- Eventually load at Kurow will exceed the transformer capacity at Waitaki. Supply from Black Pt or Livingston is an option for eliminating the need to take supply via two GXPs.
- There are three users of the Twizel GXP; Network Waitaki, Alpine Energy and Meridian. There is scope for rationalisation at this GXP in terms of the assets used for the service required. The township of Twizel is outside the Waitaki District. Alpine has a significant number of lines in the Mackenzie Basin that distribute at 33 kV. Meridian also interconnects and provides local supply to its power stations at 33 kV.
- Palmerston is on a dual circuit 110 kV spurred pole line fed from Dunedin. Capacity is therefore constrained by distance. It feeds back at 33 kV to zone substations at Merton and Waitati, and is interconnected at 33 kV through to the Naseby GXP. Palmerston is in the Waitaki

District whereas Merton, Waitati, and Naseby are not.

- While there are two 110 kV circuits, there is only one transformer at Palmerston which does not have an AVR system. Security provisions are therefore minimal at Palmerston, Merton, and Waitati. Load is also small at 3 MW but coastal development is trending upward. It is concluded that significant upgrades would be needed to service any new large industrial development in the area.
- Capacity, security, and efficiency would therefore be improved with an intermediate GXP between Dunedin and Palmerston.
- The Macreas Gold Mine (in the Waitaki District) is supplied at 66 kV from the Naseby GXP via Ranfurly (stepping up from 33 kV to 66 kV). Ranfurly is the injection point for TrustPower owned distributed generation of the Paerau hydro scheme. Naseby shares the 220 kV Roxbourgh Islington single circuit towerline with Livingstone (in the Waitaki District).

Transpower is currently investigating options for addressing the above issues, specifically the options for establishing a GXP at Bells Pond to service irrigation and load growth on the South Canterbury side of the river. Other options include a 220 kV connection on the Livingstone to Islington line or a 220/110 kV connection at the Livingstone station itself.

In short, the region is serviced by relatively high cost (with respect to competitors) transmission asset which is aged and sub-optimal in terms of modern service expectations. Given its proximity to generation, the region should be enjoying much more favourable service and cost advantages.

It is therefore concluded that Transpower is not a competitive provider of transmission solutions at non-core voltages, i.e. 110 kV. Local networks can develop local solutions that exploit proximity to generation, optimise to local security requirements, and avoid the 'one solution for all' transmission pricing methodology.

2.6.2.5 Distribution

There are three Distribution Line companies supplying Waihemo, North Otago, Ahuriri, and South Canterbury.

OtagoNet managed from Balclutha supplies the area between Dunedin and Shag Pt, including Palmerston and Macreas in the Waitaki District. OtagoNet is jointly owned by Blenhiem and Invercargill based lines companies.

Network Waitaki, located in Oamaru, services from Shag Pt to the Waitaki River and up to the top of Lake Ohau. It also services the Hakataramea Valley and the north bank of the Waitaki River down as far as Stonewall all of which are in the Waimate District. Network Waitaki is not only divided by different territorial authorities but also two Regional councils, the Otago Regional Council and ECan. Network Waitaki is the only 100% consumer trust owned company of the three.

Alpine Energy based in Timaru services down to Glenavy on the north side of the Waitaki River and the Mackenzie Basin including Twizel. Therefore it also covers parts of multiple districts. Alpine has mix of consumer trust and council ownership.

The primary distribution voltage of all three line companies is 11 kV. Both OtagoNet and Network Waitaki have 33 kV sub-transmission backbones to their networks.

Alpine takes supply from Transpower at 11 kV in the Waimate/Studholme area. This is becoming increasingly more difficult and costly to support with the more intensive loads associated with dairy development. The township of Waimate and the Dairy Factory at Studholme have security issues with the n-level GXP at Studholme.

These voltage standards are legacies of historic development. Otago has a low population density and therefore greater distances and remoteness from the transmission system to deal with. Timaru was originally a council owned MED with good transmission support to service large industrial users.

Some rural networks, with high irrigation loads, have found it necessary to move to a 66 kV sub-transmission and 22 kV distribution voltage standard. However in this area irrigation water is abstracted from rivers rather than being lifted from wells and is therefore less energy intensive.

Significant parts of the distribution networks

(up to one third of route km) are single phase. User-pays pricing makes medium to large load developments uneconomic in these areas.

An issue with the region being served by more than one lines company is that the interconnections between networks are very limited. The Waitaki River, for example, forms a natural boundary between the networks of North Otago and South Canterbury. Alpine Energy has difficulty supporting load at Ikawai, whereas network Waitaki faces challenges at Clarksville. Both these areas are at the end of long rural spur lines with no options for security or sub-transmission support. These areas, however, are seeing no less development than other parts of these networks. Service is limited as result of historical line company franchise and the misfortune of being located at the boundary.

The specific issues faced by all line companies are:

- Increasing network capacity and density to match land use intensification.
- Extending more sub-transmission support further out into the network.
- Elevating security provisions and service performance to meet the requirements of new users and higher loads.
- Increasing interconnection and robustness into network configuration.
- Ensuring that networks are capable of connecting new and larger than traditional industrial loads.
- Competing for access and obtaining options to build new infrastructure.
- Meeting development costs via fair pricing principles that do not impede progress. This is a requirement of consumer ownership of line companies. NWL, for example, is charged by its shareholders with delivering benefit to their consumers both in terms of low pricing and support of economic development.

In conclusion, the national power supply is orientated and operated to servicing larger population centres as a priority over local interest. Local power users receive inferior service yet contribute towards the cost servicing of their competitors. By contrast, in terms of economic efficiency, local users, being closer to generation resources, should enjoy beneficial location signals in their energy and transmission pricing.

The region would arguably be more competitive, better serviced, facing a lower price path, and be more attractive for economic development, if it:

- maintained a stakeholding in any new generation or obtained a stakeholding in existing generation up to 100% of local consumption;
- developed its own transmission/sub-transmission system; and
- coordinated the development strategies of its local distribution lines companies.

It should be noted that there are pricing controls on line companies that present a hurdle to them investing in transmission. They are required to return all transmission-cost savings back to consumers, which can eliminate the business case for investment, whereas they can pass through any Transpower charges without any consideration of the cost and efficiency. Establishing a regional transmission company could overcome this issue.

There are also regulatory limitations on line company ownership of generation and energy trading. A local generation and retailing company could overcome this hurdle.

2.6.2.6 Electricity Consumption Profile

Trends in electricity consumption are displaying the following characteristics:

- A shift towards summer peaking driven by land use intensification. Peaky demand profiles create opportunity to utilise off-peak capacity at minimal cost. This requires applications that turn load off during peak periods rather just peak limiting. Energy storage is therefore of higher value as a demand side management tool. Previously demand management sought to level demand and maximise load factor. Transmission pricing methodology no longer signals this objective.
- Traditional seasonal loads are becoming longer as industry operates double shifts and targets more diverse markets. System peaking can now occur in the shoulder seasons when the freezing works is operating, dairying is still in production and

Figure 2.6: Typical pattern of daily energy use (Source: TPNZ Annual Plan 2008)

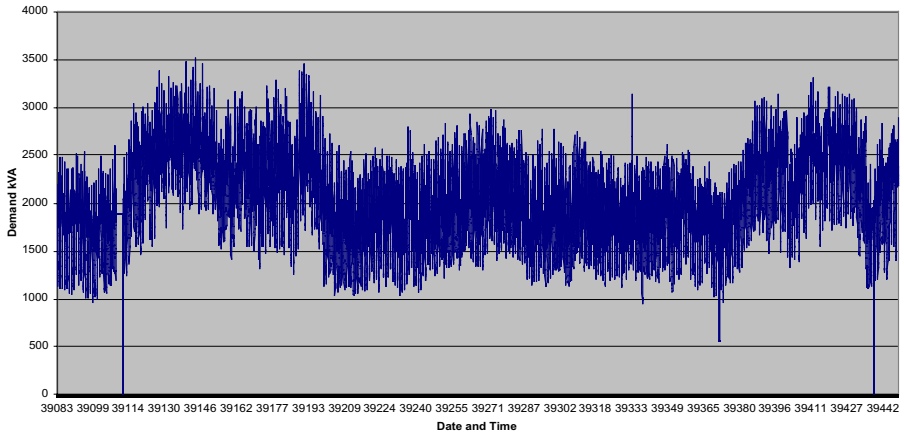

Figure 2.7: Typical season profile for rural shoulder season peaking due to irrigation load

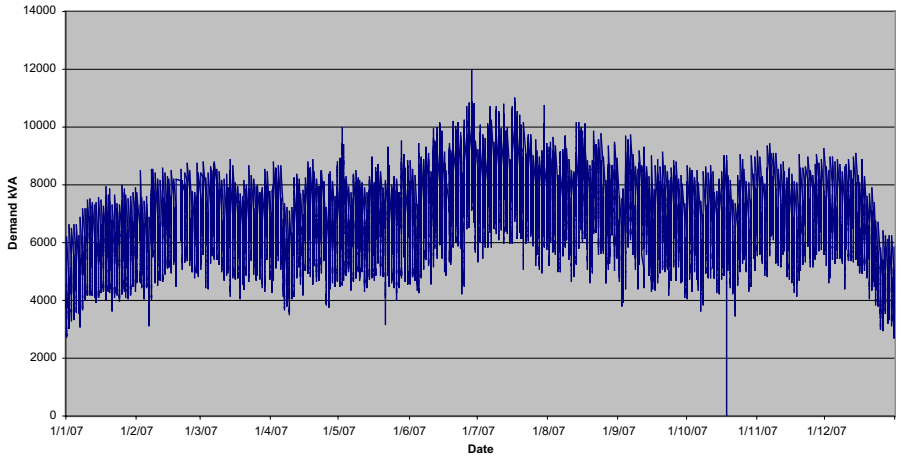

Figure 2.8: Typical season profile for urban winter peaking load

irrigation is operating because of dry conditions.

- Base load is showing a significant lift as production is increasing and consumers are shifting to on-demand convenience appliances such as heat pumps. Domestic efficiency incentives to date have resulted in increased electricity consumption.
- Holiday making is clearly evident in some feeder load profiles and often coincident with system peaks.

2.6.3 Coal

Otago has substantial lignite resources at St. Bathans, Kia Point and Roxburgh. It is low grade, high moisture content and is thus less preferred against higher rank coals for conventional thermal uses.

The lignites are amongst New Zealand's most important energy reserves. Development of these resources is under active investigation in New Zealand by a number of interested parties. Recent studies suggest an as-mined energy cost of somewhat less than $US 1/GJ, making these resources amongst the most competitive energy resources available world-wide. Environmental issues are likely to be a major issue in such developments.

The Holcim Cement Plant proposal has been consented to extract coal from a site at Ngapara. This is to be used at approximately 210,000 tonnes p.a. and is expected to last 30 years at this rate. The plant has a 50 year life expectancy so other supply options such as the Waihao deposit are considered a possibility.

2.6.4 Wood

After 2015, the combined Otago and Southland

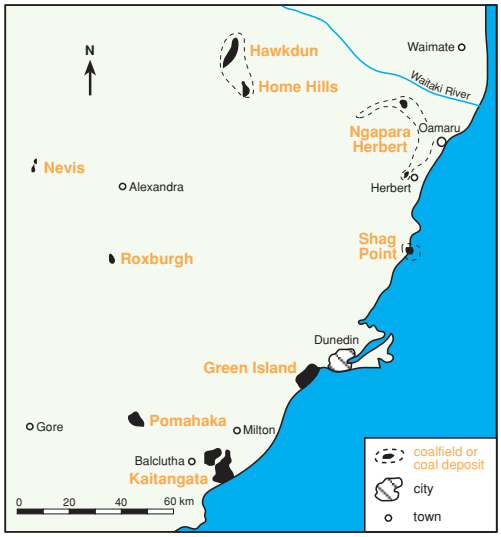

Figure 2.9: Coal resources in the Otago region

regional log harvest has the potential to increase from the current 1.5 million cubic metres, rising to about 2.8 million cubic metres from around 2020 (www.southernwoodcouncil.co.nz/pdfs/Release-Wood_Availability_1107.pdf).

Wood is a common form of stored energy in Waitaki, used mainly for residential space heating. Because of high transport costs wood is usually sourced locally, with individual households maintaining their own supply stock for various time periods of between a few months and a year or more. This buffer makes wood a good back up fuel that cannot easily be disrupted by external events.

Depending on the species, oven dry wood (<5% moisture) has a net calorific value of around 19.2 MJ/kg for softwoods and 18.2 MJ/kg for hardwoods, or 18.7 MJ/kg averaged for both. Air-dry wood (25% moisture) delivers an average net calorific value of 14.5 MJ/kg. Green (55% moisture) wood delivers around 9 MJ/kg.

Species\ Age (years)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-50	51-60	61-80	Total
Radiata pine	2403	3516	4875	1235	1604	599	197	63	*	11	*	14567
Douglas-fir	118	3960	432	28	80	140	4	9	*	0	*	4772
Cypress species	2	0	3	0	0	0	0	0	0	0	0	5
Other softwoods	33	225	156	15	23	22	1	0	49	1	0	525
Eucalyptus species	0	0	0	0	0	2	2	0	0	0	0	4
Other hardwoods	2	22	49	60	60	26	2	0	0	3	0	224
Totals	2558	7723	5515	1338	1767	789	206	72	49	15	0	20097

* Values have been suppressed for reasons of confidentiality

Source: http://www.maf.govt.nz/mafnet/publications/nefd/national-exotic-forest-2007/page-10i.htm#Table_9.10

Table 2.3: Production forest area (ha) planted in Waitaki District, as at 1 April 2007 (Net stocked planted production forest area)

Inefficiencies in combustion mean that the net energy available is quite a lot less than that indicated by the calorific value. An open fire achieves between 5% and 15% efficiency, a pot belly maybe 35%, and modern enclosed solid fuel burners between 50%-80% when used correctly. (Somewhat lower efficiencies were indicated by the BRANZ Housing Energy End Use Project (HEEP) which found 13% for an open fire and 54% for enclosed burners). Pellet burners using controlled forced air combustion can reach over 90% efficiency. The major issue surrounding the use of wood in domestic burners are particulate emissions to the atmosphere, especially in areas subject to high pollution levels.

2.6.5 Gas - LPG

Both the Great South and Canterbury basins have important implications as future prospective oil and gas resource for the region. The Great South offshore basin covers approximately 100,000 sq km near the southeast coast of the South Island (see Figure 2.10). To date eight offshore wells have been drilled with discoveries reported at Kawau-1 (flowed 6.8 mmcfd) and Tora-1. There are as yet many undrilled structures at several levels. Structural traps associated with potential mid-Cretaceous reservoirs have not yet been assessed in detail, and stratigraphic traps are unexplored. There is significant interest in exploration with Crown Minerals currently placing exploration licenses out for tender. It is reasonable to expect that after a period of quiescence, active exploration will recommence in the next several years. Commercial exploitation, however, if successful, could well be at least a decade away when the world may be facing a different global supply situation.

The Canterbury basin (see Figure 2.11) also has a proven petroleum system with large mapped structures and a significant (subeconomic) offshore discovery. The Galleon and Clipper wells drilled in the late 1970s and early 1980s contained significant hydrocarbon flows, but were plugged and abandoned as the calculated recoverable reserve was deemed uneconomic at the time. Onshore wells drilled to date have been dry. There remains a range of potential source rocks in the basin yet to be drilled with primary reservoir targets being late cretaceous or eocene sandstones, with potential similar to the Taranaki Basin. Further exploration can be anticipated in this basin.

There will need to be an adequate market (quantity and price) for this development to proceed. A long lead time should be expected before any delivery to shore. Major onshore facilities at an appropriate near shore location and access to harbour facilities may need significant development.

2.6.6 Transport fuels

There is no current local road tax on fuel and if applied it could exempt biofuel blends.

US dollar prices/ barrel required for oil alternatives to be economic are currently estimated in the following ranges:

- Biofuels (sugar cane based) - $35 to $60
- Oil sands (mining) - $46 to $62
- Oil shale - $50 to $87
- Oil sands (in-situ) - $60 to $70
- Biofuels (corn based) - US$65 to US$95

The fuel price might therefore be expected to be closer to $60/barrel as production capacity is built.

Oil prices have increased rapidly since 2004 peaking mid-2008 at around US$147/bbl compared with the previous price band of $20-$40/bbl, which the price followed during the 1980s and 1990s.

In the road transport sector, fuel costs have been rising fast. In New Zealand dollars, West Texas intermediate crude oil prices rose 10.4 per cent per annum on average from the March quarter of 2002 to that of 2007. But in the year to March 2008, those prices rose 48.1 per cent. Those huge increases fed through to the petrol and diesel pumps in New Zealand. From the March '02 to the March '07 quarter, petrol prices in the CPI rose by 7.9 per cent per annum. From the March '07 to the March '08 quarter they soared by 20.9 per cent.

That is impacting on the amount of fuel we consume. Forecasts are a nil growth rate in petrol demand over our first Kyoto commitment period, from 2008 to 2012.

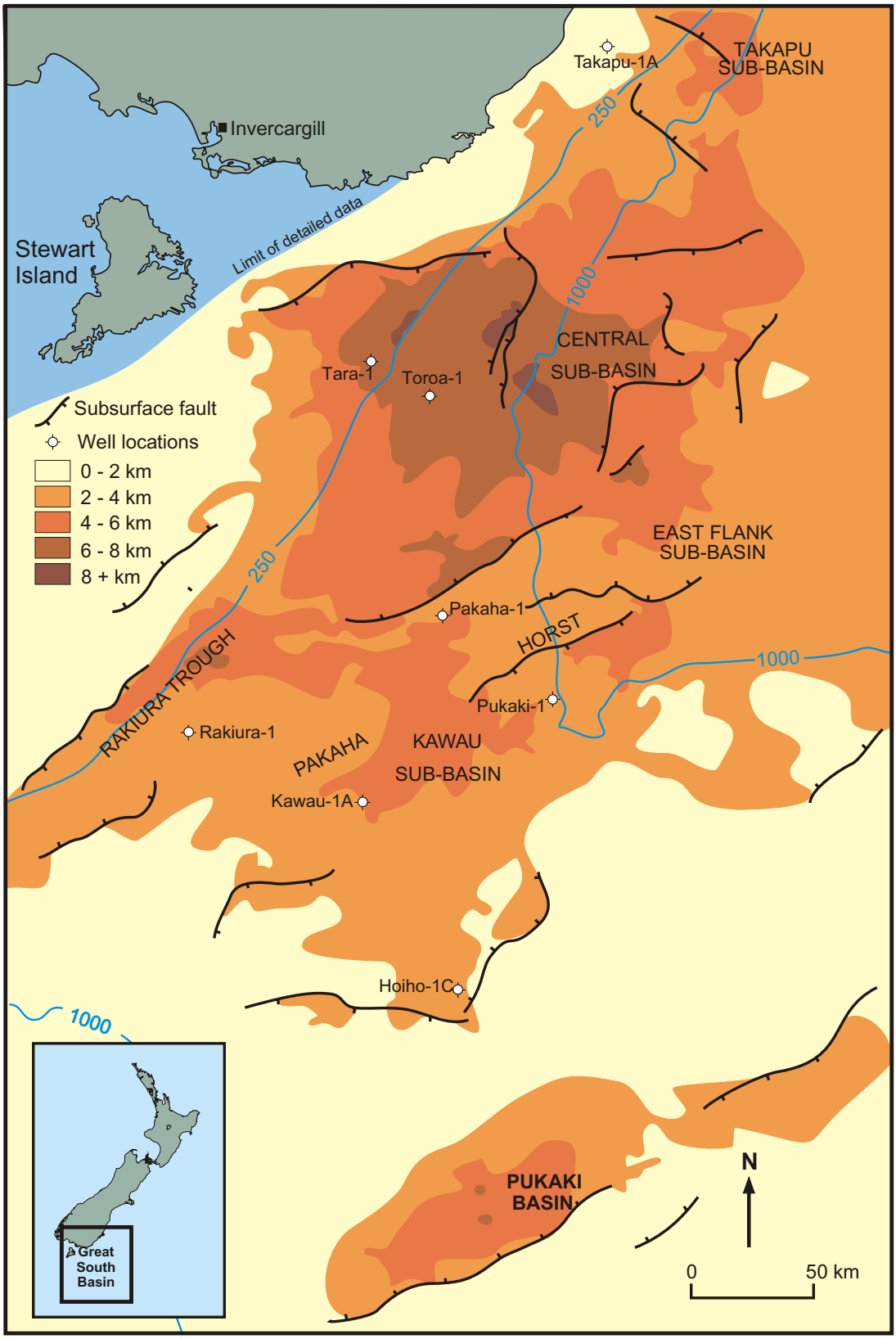

Figure 2.10: Great South Basin
(Source: www.crownminerals.govt.nz/petroleum/basins/map-grtsth.html)

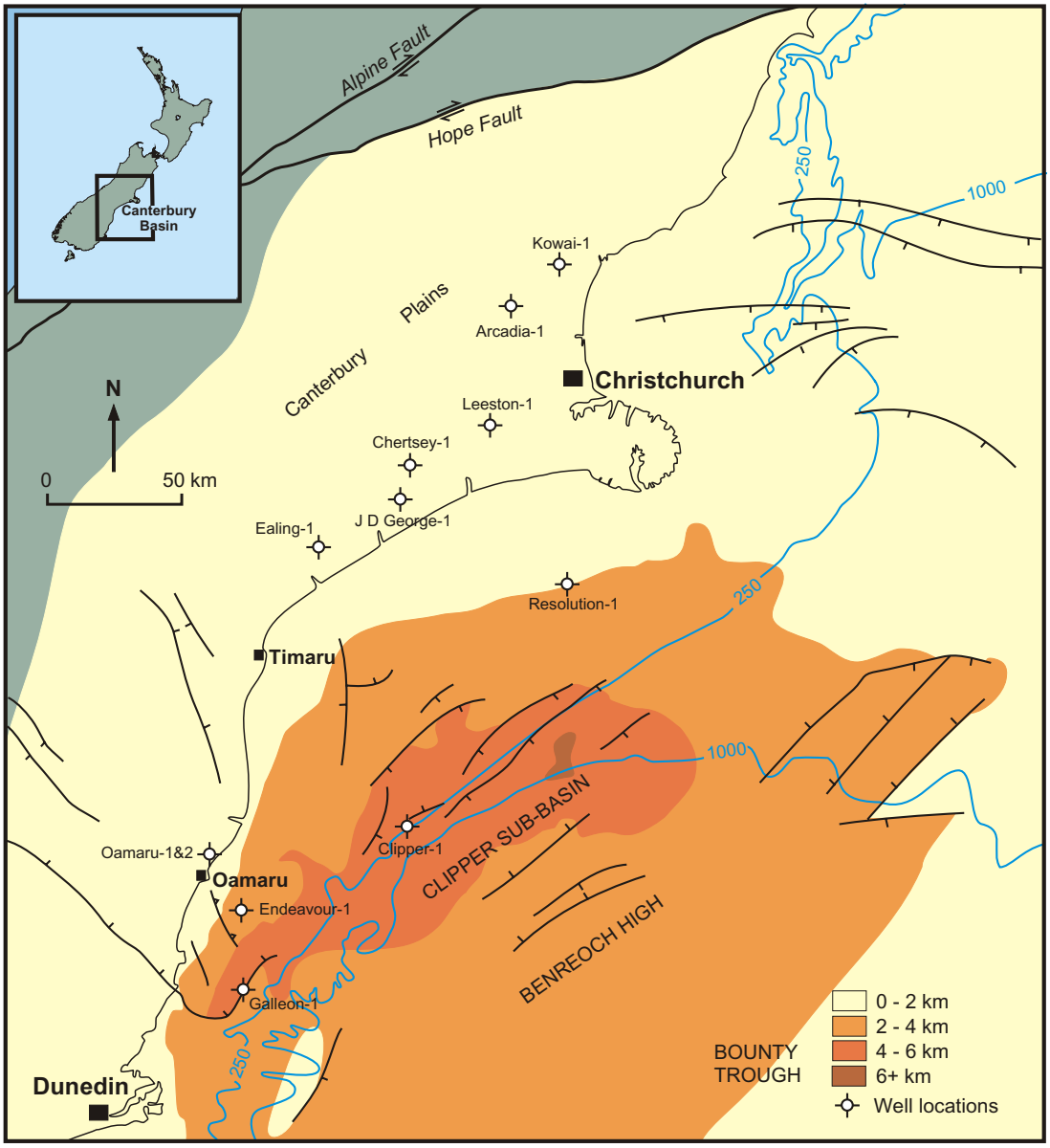

Figure 2.11: Canterbury Basin
(Source: www.crownminerals.govt.nz/petroleum/basins/map-grtsth.html)

In 2007 Biodiesel New Zealand produced about 1 million litres of biodiesel a year from its Christchurch plant by converting used cooking oil collected from restaurants and other food businesses. Solid Energy has purchased the company and now aims to lift annual production to 70 million litres within three years, which will meet more than half the government's 2012 target for biofuels.

The company is also investigating the potential for producing biodiesel from energy crops such as canola. New Zealand currently uses about 3,500 million litres of diesel a year. Biodiesel also offers safety advantages over mineral diesel in underground mines because of the lower emissions.

(See www.infonews.co.nz/news.cfm?l=1&t=106&id=1487 and www.beehive.govt.nz/speech/speech+canterbury+manufacturers%E2%80%99+association).

3 NEAR FUTURE AND FUTURE TRENDS

3.1 General Observations

Growth in energy consumption leads economic growth. Economic growth requires growth in productivity which generally results from greater consumption of energy.

Example: Producing more milk requires pumping more water, applying more fertiliser, carting more milk to larger dairy factories, before transporting product overseas.

Energy efficiency initiatives can result in increased energy consumption and a shift to electricity in particular.

Example: Air conditioning is an efficient technology. However it displaces traditional heating fuels with electricity and is used in summer for cooling. Total energy expenditure increases and usage patterns change, i.e. consumers opt to receive benefits in the form of higher service levels than savings on their energy bill.

Energy supply must therefore be developed ahead of economic development to avoid becoming a constraint on development. Forecasting cannot rely on projection of past data. It must predict future trends with regard to econometrics and technology change.

3.2 Waitaki District Population and Dwellings Projections

Council forecasts predict Waitaki District should see an increase in population and dwelling numbers over the next 30 years. Strong growth in the number of dwellings is expected, with a 28% increase in dwelling numbers expected over the next thirty years. The growth in dwellings is due to the impact of the national trend towards smaller households, and an increase in holiday homes in some parts of the District.

There were 14.3% more new dwelling consents issued for the Waitaki District over the year ended March 2008 when compared with the year ended March 2007 (from a total of 105 for the year ended March 2007, to a total of 120 for the year ended March 2008). *(Source: Statistics NZ - Quarterly Review March 2008.)*

Statistics New Zealand predict a decline in the Waitaki District population. Statistics New Zealand also predict the median age of 56 years in 2031 in Waitaki District.

However the Waitaki District Council commissioned Rationale Limited to carry out additional research on the impact of three factors that it considered were likely to have a substantial effect on population. These were irrigation expansion, winery expansion, and the development of the Holcim Cement Plant. Rationale used existing research regarding the impact of development of irrigation, winery and Holcim Cement on the workforce, to develop a set of alternative population projections. These predict that the usually resident population of Waitaki District will increase from 20,223 in 2006 and peak in 2016 at 22,203 residents, and then decrease to 21,298 in 2036. The main growth drivers are the six rural townships (Hampden, Kakanui, Kurow, Moeraki, Omarama and Otematata), and the Oamaru Surrounds area.

The number of dwellings is projected to grow significantly faster from 10,392 dwellings to over 13,300 dwellings. This is an increase of almost 28% that can be attributed to localised population growth, new holiday homes in some locations and the trend towards smaller households across the district. Due to the significant dwelling growth the peak day population is expected to increase from around 39,000 in 2006 to over 48,650 people by 2036.

This highlights the increasing popularity of certain coastal and lakeside townships as holiday destinations. The peak population comprises of both the usually resident population and all visitors in an area on the busiest day. This is needed to ensure that services and infrastructure assets are adequate to cater to the needs on a peak day.

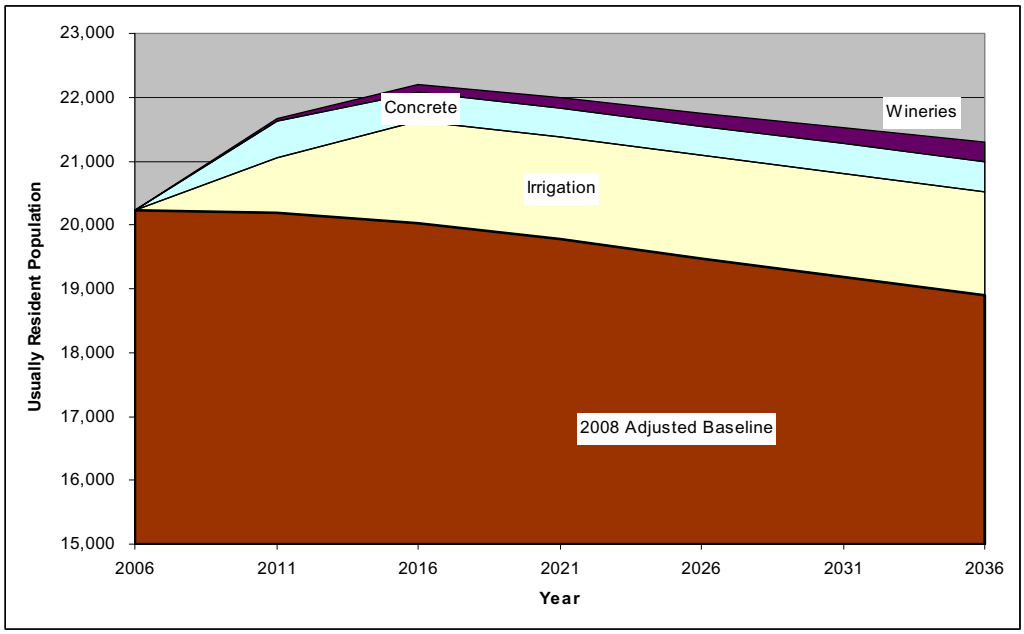

Figure 3.1: Waitaki District Usually Resident Population
(Source: Waitaki District Council Growth Projections)

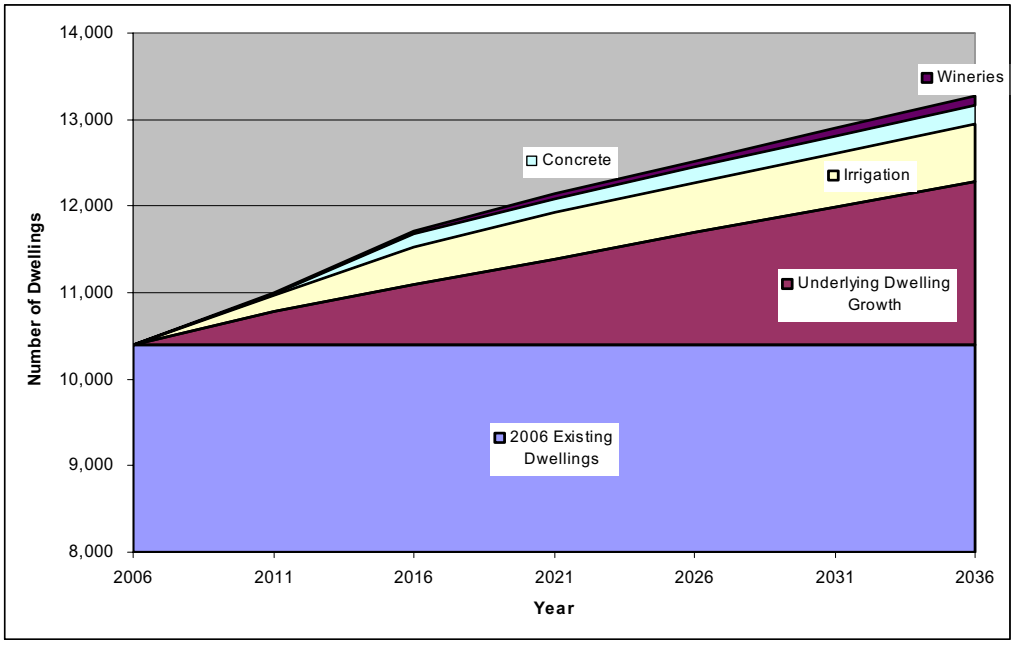

Figure 3.2: Waitaki District Dwelling Growth
(Source: Waitaki District Council Growth Projections)

3.3 Electricity Energy Demand Forecasts

3.3.1 Forecasts with respect to Electricity Generation Development

Planning for new generation is no longer a centralised government controlled decision making process. Generation is developed on the basis of commercial merit in a competitive energy market by competing generation companies. The market environment in which these companies make their investment decisions is determined by governance rules created by the Electricity Commission (EC).

In order for the Commission to meet its Government Policy Statement, GPS, objectives

regarding security, enabling renewables, etc., it must form an opinion about the likely development scenarios, their probabilities of being implemented, and timings when new generation will come on line. It signals its preferences and needs by publishing a Statement of Opportunities (SoO).

The SoO is limited by its own conservativeness with respect of certainty, a hurdle that new development must overcome to be relied on for planning purposes. Alternative solutions that have shorter development cycles than traditional power system development fail to deliver the required certainty and are therefore excluded too early in the process. The SoO is particularly weak in its consideration of emerging technologies (such as low cost mass market PV cell installation), distributed generation (because multiple solutions are needed), alternative energy (such as solar heating), demand-side management and energy efficiency.

A further influence on generation development is the Energy Strategy moratorium on building new thermal plant. The Waitaki's large-scale opportunities are all renewable compliant with the exception of the gas/oil discovery off the east coast.

With regard to new generation the Electricity Commission is signalling a priority for wind farm development in the South Island and geothermal generation in the North Island. Hydro development is secondary and the SoO identifies development of the Clutha river as being more cost competitive than the Waitaki River.

Hydro development in Marlborough and the West Coast, while smaller and more expensive than the Waitaki, are also likely to proceed ahead of the Waitaki because of their other advantages with respect to transmission upgrade and security.

There does not appear to be any consideration to developing more water storage on existing hydro schemes at this time. Hydro generation is a particularly expensive form of generation if storage is required to operate it. As water resources becomes more valuable and generation portfolio becomes increasingly less firm with the addition of wind power, the economics of storage development may improve. The current market structure does not reward storage owners adequately.

An additional challenge for the electricity market is the coordination of investment from a national efficiency perspective. Investment decisions may be made by one competitor on the basis that it will devalue or reduce the competitiveness of another competitors existing generation portfolio. This behaviour is not in the interests of consumers nor of national benefit. It exists because generators have large strategic assets that allow them assert market power.

Similarly, transmission pricing methodology does send strong location signals to generation developers. This allows generation to be exported to other locations, such as Christchurch, via lines developed at power consumer cost, rather than the alternative more efficient outcomes, such as building generation beyond the transmission constraint or incentivising large industrial users to locate in the Waitaki District close to existing generation.

With respect to security and services, this region competes with those being provided in larger population centres. A particular weakness for the district is not having sites where a development requiring power supply in the range of 5 MW demand could be built without major power system development.

3.3.2 Load Growth Forecasts with respect to Transmission of Electricity

Transmission planning is based on methodology prescribed by the Electricity Commission. The Commission provides Transpower with a demand forecast and a set of Grid Planning Assumptions with regard to generation development and security issues on which to prepare a Grid Upgrade Plan. This Plan is then subjected to a Grid Investment Test to ensure the development is economically justified. Once the Grid Upgrade Plan is approved by the Commission, Transpower is able to recover its investment costs via the Commissions Transmission Pricing Methodology.

There are several disadvantages for local users with this process:

- The Commission's forecasting is only as

good as its intelligence with regard to new load. Forecasting tends to be based on extrapolation of historical data and inclusion of projects with a relatively high level of confidence in their development. In this region, the EC forecast is substantially under-estimated.

- Economic development and the investment cycles of industry are significantly quicker than the process of approving and building new transmission assets. There is no mechanism (because of the requirement for certainty) to allow development of transmission ahead of economic development. Accordingly the system is not enabled for economic developments and in fact presents a capital cost hurdle. Development times and the uncertainty risk of realising approvals can kill off projects.
- The Grid Security Standard only permits Transpower to provide n-1 security provisions for the core grid where connected load is over 150 MW. The 110 kV system supply local service is not classed as core grid. Also its aggregated load forecast fails to reach the 150 MW requirement.

This has two disadvantages for regional economies:

- Firstly, by virtue of size of the aggregated load, unless part of a major city the power supply will not be sustained at n-1 security. This reduces attractiveness to new industry and is inherently inequitable because local businesses make no less contribution to the national economy than their city equivalents. The core grid is averaged costed.

  Example: The 2006 snow storm occurred at the same time as the Otahuhu Substation outage. It was unacceptable that the coffee shops of New Market lost 8h trading but completely ignored that the coffee shops and hotels of Twizel (servicing our important tourism industry) were without power for 3 days, despite being located right where the power is generated. As a consequence of this outage Auckland is receiving a massive security upgrade to which the businesses in Twizel will contribute payment.
- Secondly, when key large local businesses have been enjoying n-1 security for many years and are reliant on its continued provision, and growth has reached the point where a transmission upgrade is required (as is the case in Oamaru), the EC will not approve the upgrade until the redundant capacity inherent in the n-1 standard has been consumed, i.e. security has been reduced to n level. This directly threatens retention of local industry and makes the region unattractive to new industry.

Transmission and grid connected generation are in competition with alternatives that are likely to prove more efficient for smaller regional power supplies, such as distributed generation development. Current planning systems are transmission solution centric and the process favours the status quo rather than modernisation.

Essentially a resource rich location like the Waitaki should be able to create a more favourable local economic outcome than the share delivered to it by the larger national economy. It fails to attract its fair share of the wealth created from its resources with the result of a declining economic position as businesses consolidate to bigger centres.

It is apparent to both Network Waitaki and its neighbour Alpine Energy that the EC's forecast for the Waitaki Valley is inadequate in terms of new developments progressing with reasonable certainty and that the existing transmission system urgently needs upgrading to meet development timetables.

An improved forecast has been developed by Transpower and agreed to by the two line companies involved. This forecast is provided in Table 3.1. It suggests that load will grow by 100% to 100 MW over the next 10 years.

This level of load is beyond the development potential of the existing 110 kV system. The level of development required will challenge the normal timeline Transpower is able to deliver on.

Transpower has engaged BECA to investigate upgrade options for the transmission. Line companies will then need to make a decision about whether these solutions meet their own affordability, service level, and development path of sustainability objectives. The final hurdle will be Transpower passing the EC's Grid Investment Test (which can be challenged by other affected parties).

GXP	Forecast	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Oamaru	Prudent	32.4	34.1	34.8	35.0	45.6	48.4	51.6	55.0	57.5	58.9	60.1	61.3	62.5
	Mean	32.4	33.9	34.3	34.2	43.6	45.9	48.8	51.7	53.8	54.9	55.7	56.5	57.4
Waitaki	Prudent	4.6	6.5	7.1	7.1	7.1	7.3	7.5	7.7	8.0	8.2	8.4	8.7	9.0
	Mean	4.6	5.9	6.4	6.3	6.2	6.3	6.5	6.7	6.8	7.0	7.2	7.4	7.5
Black Point	Prudent	9.9	9.9	12.0	23.0	25.3	26.1	26.3	26.5	26.7	26.9	27.1	27.3	27.5
	Mean	9.9	9.9	12.0	22.2	24.4	25.2	25.3	25.4	25.5	25.7	25.8	25.9	26.0
Studholme	Prudent	16.5	19.1	24.3	28.0	31.2	33.0	34.7	69.6	72.1	74.5	76.9	79.3	81.7
	Mean	16.5	19.0	24.0	27.4	30.2	31.8	33.3	56.6	57.5	59.5	61.4	63.3	65.2
Waitaki Region Undiversified	Prudent	63.4	69.7	78.2	93.1	109.2	114.7	120.1	158.8	164.2	168.5	172.6	176.6	180.7
	Mean	63.4	68.7	76.6	90.0	104.4	109.2	113.9	139.3	143.6	147.0	150.0	153.1	156.1
Waitaki Region Diversified	Prudent	59.4	65.3	73.3	87.3	102.3	107.5	112.6	148.8	153.9	157.9	161.7	165.5	169.3
	Mean	57.3	62.1	69.3	81.4	94.4	98.8	103.0	126.0	129.9	132.9	136.7	138.4	141.2

Table 3.1: Load forecasts, Waitaki District

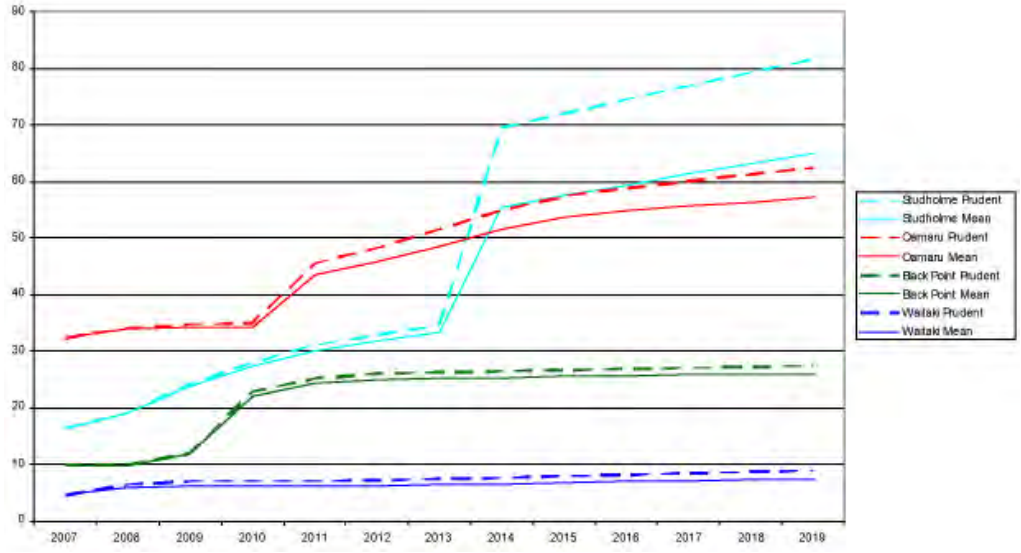

Figure 3.3: GXP forecasts – mean and prudent

This process will also result in solutions that maximise Transpower's position. As sole transmission provider they can extract a monopoly premium.

The level of investment required is likely to be very large (over $50M). Being non-core asset the cost will eventually be fully recovered, at commercial rates, from local users. The long-term implications of the decision are very important for the region as these assets need to deliver their maximum benefit, for as long as possible, to extract full value from them. The assets involved are of strategic value and therefore consideration needs to be given to retention of local ownership/control over these assets.

The short- to medium-term developments driving the urgency in transmission upgrade are:

- stage 2 of the Studholme Dairy factory;
- stage 2 of the NOIC Black Pt irrigation Scheme;
- the Holcim Cement Plant proposal at Weston;
- the Hunter Down Irrigation proposal and/or its alternative/variants;
- continued on-farm irrigation and dairy development; and
- district water supply upgrades.

3.3.3 Load Growth Forecasts with respect to Distribution

Line companies are required to forecast and plan network development as part of a prescribed and disclosed Asset Management Plan. The regulatory objective of this process is to prevent monopolistic over-investment in assets as a means of increasing revenue collected from consumers.

In short, if the development cannot demonstrate necessity or a justified improvement in service, then price controls will constrain investment. This control can stifle innovation of local solutions for local issues and fails to incentivise capital efficiency.

Long-term strategic planning processes need to consider at what point voltage standards, security standards and network configuration design philosophies need to change as load grows and usage changes. Maintaining a sustainable development path and minimising transition issues are strategic considerations that do not necessarily get adequate attention in short-term narrowly focused development plans.

Technology change also affects the need for network development in time frames shorter than asset life cycles. Prudent consideration of future trends must be included.

As can be expected when the 110 kV transmission is under pressure in terms of its ultimate development potential, so too are distribution networks. Increased load density requires increased distribution network density, i.e. more lines, larger conductors, higher transformer density, and more interconnection.

Sub-transmission systems provide a back bone for distribution networks and allow optimisation of whether issues are managed via transmission or distribution solutions. Upgrade of distribution lines can be avoided by increasing the density of sub-transmission feeds. Sub-transmission systems can also provide alternatives to transmission security upgrades via interconnection between GXPs.

Local line companies are investigating sub-transmission development as an alternative to very costly transmission upgrade and excessive widespread distribution line reinforcement. In order to deliver cost competitive solutions the ability to secure line routes and substation sites is critical.

Where line companies do not have an existing sub-transmission, they only have the choice of costly sub-optimal transmission and distribution upgrades. A hurdle to their willingness to develop sub-transmission is that they are not permitted to capture the transmission savings involved which funds the development. The more costly and less efficient transmission solutions can be passed through to consumers regardless. This situation exists in the Alpine Energy area which has a lack of sub-transmission and takes supply directly from Transpower at 11 kV.

Sub-transmission support is also weak between Maheno and Palmerston, Ngapara and Kurow, the Hakataramea Valley and the North Bank of the Waitaki River, and Waitaki and Twizel. Transmission, sub-transmission, and distribution are particularly limited in the Upper Waitaki Valley centred on Duntroon (both sides of the river) where significant dairy farm development has occurred in recent years. A combination of GXP and sub-transmission development is needed to address this issue. This will be a necessity for development of irrigation in the Hakataramea and Hunter Downs areas.

Table 3.2 provides NWL's forecast of load growth at its Zone Substations (33/11 kV points of supply), including new substations yet to be built.

NWL's 33 kV sub-transmission system has the configuration shown in Figure 3.4.

3.3.4 Sub-transmission upgrades

The following sub-transmission upgrades are assumed in NWL's Network Development Plan:

- Construction of a dedicated 33 kV feeder from Oamaru GXP to the proposed Holcim Weston Cement Plant.
- Establishment of a 33 kV Point of Supply at Black Pt.
- Development of 33 kV Ring between Oamaru and Black Pt linking the existing 33 kV zone substations at Ngapara and Papakaio.
- Relocating the Ngapara Substation closer to NOIC's Millars Pond such that dedicated feeders can be provided for their Plateau Line development.
- Development of a 33 kV line from Black Pt towards a new Zone Substation in the Duntroon area.
- Possible 33 kV interconnection of Kurow and Duntroon Zone Substations.

Demand Forecast (MW)												
NWL GXP	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Oamaru GXP	34.4	36.8	37.3	48.5	51.5	55.1	58.8	61.6	63.5	65.1	66.7	68.4
Waitaki GXP	8.5	9.1	9.2	9.3	9.6	9.9	10.3	10.7	11.0	11.4	11.8	12.2
Black Pt GXP	9.9	11.9	22.1	24.3	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8
Undiversified Total	**52.8**	**57.8**	**68.6**	**82.1**	**86.2**	**90.2**	**94.4**	**97.6**	**100.0**	**102.0**	**104.2**	**106.3**

Table 3.2: NWL forecast of load growth

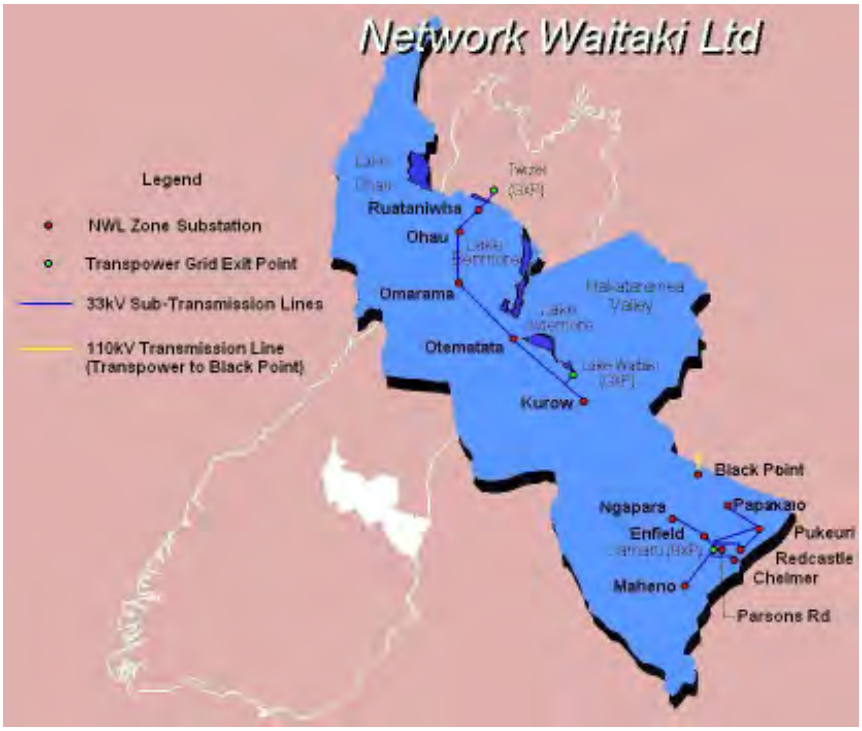

Figure 3.4: NWL 33kV sub-transmission system configuration

- Possible development of a new zone substation at Georgetown to meet security requirements with regard to contingent 11 kV capacity and transformer security.
- Extension of the Maheno 33 kV line and construction of an additional zone substation at Hampden.
- Upgrade of both the Oamaru urban zone substations, Chelmer St and Redcastle Rd, to a dual 20 MVA n-1 configuration.
- Upgrade of the Pukeuri Substation (supplying the Alliance Pukeuri Works) to a dual 10 MVA transformer configuration.

Longer term development possibilities include:

- Development of an intermediate zone substation between Oamaru and Maheno to meet the demands of more intensive land use.
- Development of a 33 kV line and substation into the Five Forks/Tapui area to support irrigation development.
- Extension of the sub-transmission system from Kurow and/or Duntroon across the river into the Hakataramea and Clarkesville areas.

3.4 Alternative Electricity Generation

3.4.1 Wind

Whilst there currently is no wind energy development in the district (excluding direct stock water pumping) wind technology is now established as a mainstream generation technology in New Zealand. Discussion of its potential as both grid connected and distrib-

uted generation is discussed in Section 5.

3.4.2 Photo-Voltaic

Whilst sunlight is free, collection and transfer to usable power requires technological advancement before this form of energy can take its place as a *commercially viable renewable energy source.*

Advances in PV technology are now at point where thin film products can be moulded into building components. Costs have been lowered to US$2/W. Construction of production plants is well advanced and due to begin manufacture in 2009. Large-scale installations by utilities have booked all production capacity until the end of 2010. The long-run cost as sales volume and production capacity increases is expected to drop to NZ$2,000/kW (compared with $7,000 currently) assuming power system connection, i.e. no batteries.

At this level PV will be lower cost than centralised grid connected generation options and mass market installation is likely to be triggered. PV systems interconnected to each other via the existing electricity infrastructure do not need battery storage.

It should be noted that the arrival of this technology to the mass market will coincide with the arrival of affordable electric car technology. These two technologies complement each other in that cars will have battery storage.

The implications for infrastructure are:

- The electricity network will need to be adapted from one way power flow distribution to a more dynamic and active network providing reliability services and managing net power flows.
- Domestic consumers will have more self-sufficiency and so less expensive security provisions will be required.
- Bulk users of power will become the main users of the network in its current mode. Infrastructure will adapt to their specific requirements.
- Different pricing methodologies will be required and the industry structure and markets will change.
- Role of the transmission grid similarly changes.

Photovoltaics (PV) is one of the more direct methods of harnessing the sun, and a plentiful energy supply. PV is undergoing quite a boom worldwide. Since 2000, production has been roughly doubling every two years, making PV the fastest-growing energy technology in the world. On the technical level, incremental advances in conversion efficiency, particularly with low-cost materials, are bringing both financial and environmental costs down. There are also newer approaches being investigated which could yield large jumps in efficiency, to as high as 60%. As the technology develops, it will only become more attractive economically, and environmentally – the energy payback time for crystalline silicon PV cells has reportedly dropped from over eight years in 2000 to about two years now.

Installation of PV modules is undergoing rapid growth. Government policies like those in Germany and Australia are having major effects on uptake of the technology particularly at the small-scale level. In these countries, financial incentives such as subsidies and feed-in tariffs (allowing PV owners to sell excess power back to the grid) are helping to ease the financial burden on investors.

It is important to acknowledge the potential impacts of PV – there are potential health hazards of the PV and battery materials. PV remains one of the most promising options from the point of view of its low maintenance and quiet operation. Ensuring that buildings have adequate solar access and suitably designed roofs is a planning issue.

3.4.3 Wave and Tidal Power

hese have not reached the point of being economic in New Zealand yet, but there is no reason to believe that it will not be economic or feasible in the foreseeable future. A 20 MW sized wave power farm is currently being constructed off the coast of Cornwall in the UK and a 3 MW plant is being constructed off the coast of Scotland.

In fact, when/if it does, given its 24-hour constant and predictable nature, it has the potential to be a far better power source than any before. We should ensure that the Waitaki District can take future advantage of this energy technology when it becomes available.

There may be the possibility of some coastal erosion mitigation in the longer term.

3.4.4 Waste-to-Energy

Heat and power generated from waste (Industrial heat & steam, municipal waste) is another future opportunity. This type of generation is often linked to incineration schemes, and technologies such as high temperature pyrolysis offer opportunities for the production of electricity. Fuel quality management tends to be issue for these schemes. Consequently they are usually associated with a host industrial process that has a suitable fuel stock and operate in a cogeneration mode (heat is the main energy output). Also methane gas can be and is produced from organic waste at sewage plants.

An emerging technology is the anaerobic digestion of dairy shed effluents to produce methane biofuel. The technology is sufficiently mature for implementing and offers the additional benefit of improved effluent irrigation to land (see box overpage).

Examples

The Holcim Cement plant: proposes to supplement its coal burning with waste oil. Its high temperature kiln is able to breakdown this potentially hazardous waste into clean combustion byproducts. Cement is an energy intensive industry with energy accounting for 30%-40% of production costs (i.e. excluding capital costs) (IPPC, 2001). The building of a new cement works will require a large amount of energy: coal, electricity, some waste fuels, transport fuel for trucks and rail. If gas was readily available at a competitive price this could be used. Holcim has proposed very high compliance standards and sustainability improvements compared with existing operations, and this sets the benchmark for new development and consent renewals. There are also lessons to be learned about what provisions are needed in the District Plan to allow large projects (see also 6.3 *Provide Leadership*).

Summit Wool Spinners: The waste pond (28 degrees) at Summit Wool Spinners Ltd in Weaver Street, Oamaru has potential as a source of low-grade heat energy. This 20,000 square-metre factory accommodates a wide range of yarn producing activities for both woollen spun and semi-worsted spun yarns. Energy conservation is identified as an issue that the Company will consult and communicate openly with members of the community (http://www.summitwool.co.nz/profile.htmo.

3.5 Wood

The environmental benefits of planting trees and using more wood are being promoted by industry with support from government. Government policy is that all new government buildings consider a timber structural option from mid-2008. Research is being undertaken on maximising the use of wood in sustainable buildings. A major outcome from more timber availability is the potential to use the wood waste as a fuel. The carbon locked up in timber in buildings is one way to effectively reduce CO_2 in the atmosphere. Forests, woodlots, shelter belts and coppices have been sustainably managed for fuel, carbon, food, and building material in Europe for thousands of years. It is not difficult, can be achieved without fossil fuel dependent technology, and New Zealand has the space to dedicate to it. The associated 'greening' of the landscape not only has obvious living environment benefits but would add to its attractiveness to tourism.

An appropriate and alternative response for a dry land area to irrigation is the development of shelter belts of tree fodder. Energy efficiency is an obvious benefit of this approach. A land management sustainability plan would help the district determine a balance between these options.

Tree crops can also to produce biofuels by digesting cellulose to produce alcohol.

One issue that could be better addressed via a coordinated community project is improving the quality of firewood with wood drying facilities exploiting waste heat or solar heat sources.

3.6 Coal

3.6.1 Coal seam gas – carbon neutral CSG

Exploration is progressing in Southland and Central Otago (see section 2.6.3).

On-farm waste-to-energy solution

An on-farm energy system BioGenCool™ transforms cow effluent into power that is used to heat and cool while providing a greatly reduced electrical load. Ian Bywater has painstakingly and carefully researched and developed the system with the intention of how technology can deliver energy from renewable sources, at low-cost and with benefits to the environment through a reduction in greenhouse gas emissions. The BioGenCool™ process extracts the biogas (methane gas and carbon dioxide) from the cow effluent using novel biodigester technology. After production it is then cleaned and used as a fuel in a cogeneration plant to generate electricity. The process converts the volatile organics into biogas, leaving the resulting supernatant liquid low in bacteria, nitrogen rich, cleaner and more readily assimilated than raw manure. This therefore makes it paddock ready for disposal around the farm.

The conversion of the biomass produced by a typical dairy herd is sufficient to provide the energy to meet most of the demand for vacuum pump, hot water and milk chilling requirements.

The quality of milk is directly related to the temperature at which it is stored. Currently in New Zealand most milk is stored at below 7˚C, though an EU Standard requires that milk be stored at 3˚C. The BioGenCool™ system provides rapid efficient cooling to 3˚C using a secondary heat exchange subsystem and delivers milk for transportation that is foam free.

Technical director Ian Bywater reports that a farmer with 850 cows could save up to $30,000 a year in electricity costs. The Canterbury project has been very successful and fully demonstrates how BioGenCool™ can save up to 35% of the energy used in the dairy shed. In addition to this there are savings in water consumption through recycling by using 'greenwash' in the dairy shed yard.

http://www.naturalsystems.co.nz/BioGenCool.html

Ice banks for milk cooling

Ice banks are sometimes used to provide chilled water because they have the added advantage of providing a method of storing cooling energy for later use. They were sometimes used in the early days of mechanical refrigeration when low-powered refrigeration systems were unable to cool the milk quickly enough. By storing the cooling energy as ice, the refrigeration unit could operate at low power over a long period to provide the required cooling. It is understood that some of these ice banks are still in use in remote areas of New Zealand where electricity supply capacity is limited. For a similar reason, the BioGenCoo™l system currently under development in Canterbury uses an icebank to spread the refrigeration load across the whole day and so provide a steady base load for an on-farm generator partly powered by biogas.

The use of ice banks (or chilled water storage tanks) on dairy farms to shift electrical load from periods of high demand to periods of low demand has also been suggested by many and adopted by some. While this may be of advantage to the owners and operators of the electricity supply network, the incentive provided by current electricity pricing is not sufficient to make this a common practice. Some equipment suppliers and energy advisers promote the use of thermal storage systems as a means of reducing electricity costs. An advantage of using a chilled water storage system to provide most of the milk cooling is the ability to re-charge the chilled water store at night when electricity prices are lowest.

http://www.southlandnz.com/Portals/0/Documents/Business/Regional%20Initiatives/Technical%20Report.pdf

So what will the regenerative rural landscapes of the 21st century look like?

SIMON SWAFFIELD (2008) explains how New Zealand could benefit from a long-term vision of landscape regeneration.

They will vary widely depending on the underlying landscape structure, but they will all incorporate green-blue networks that reveal and express the hydrology of the area. They will include more tall woody vegetation, particularly on steeper land, and associated with waterways. There will be more indigenous vegetation, in many cases interwoven with exotic species, for example in shelter belts and as under-story to plantations. But they will not look as picturesque as the food adverts suggest. Consumers will come to understand that what looks good, according to picturesque conventions, may not be good ecologically. A new frame of aesthetics will be needed, based upon an understanding of ecosystem dynamics.

In the regenerative landscape of the 21st century, it will be essential to demonstrate responsible management for farmers' self-esteem, for community acceptance, and to provide confidence to distant consumers that the New Zealand rural landscape truly is a morally legitimate source of food and fibre.

These approaches would acknowledge that New Zealand rural landscapes are being transformed at the intersection of the open market and sustainability policy agendas. They would give us better capability to respond to the future management challenges from the direct effects of climate change, peak oil, and eco-consumerism, and from the new policy regimes that are emerging.

Implementation of a regenerative vision will require inspired leadership from rural stakeholders and politicians, as well as committed and consistent policy and planning.

http://www.stuff.co.nz/thepress/4706629a12935.html

While coal seam gas is considered to be an non-conventional gas, the proliferation of areas in New Zealand under exploration and development mean that it is rapidly becoming main stream. The potential of New Zealand's coals to produce coal seam gas has been recognised for some time. However, key market drivers have not been suitable for the progression of this potential into reality. Plans for the commercial exploitation of coal seam gas in the Waikato have been announced by Solid Energy. A demonstration well is currently generating approximately 1 MW_e for local supply. In the South Island, L&M Group are completing a major assessment of the coal seam gas potential of Southland and Otago.

This assessment of the coal seam gas potential has been undertaken in a staged programme. Preliminary assessment of the data on the permit areas indicates that the potential resource may be up to 500 PJ. To date, preliminary appraisals have been completed or are underway on a significant number of fields. Exploratory drilling has been completed or initiated on several of those fields, with results from this work being fed into the preliminary modelling as it has become available.

Given that in many of these areas there is no pre-existing information concerning their gas potential and world wide experience with lignite is practically nonexistent, it has been a steep learning curve with many surprises. However, initial gas content results and preliminary gas flow models have been on the whole, rather pleasing, with the commerciality of some developments already apparent.

3.6.2 Lignites

Lignite coal is very suitable as a feedstock for conversion to transport fuels. South Africa now supplies about 40% of its oil needs with coal-to-liquids (CTL) technology, insulating it against the threat of oil supply shock that the rest of the developed world faces – an enviable

position. In a recent study published by JP Morgan, it was estimated that the average per-barrel production cost for such plants would be in the area of $US48, including the cost of carbon dioxide removal, a key environmental consideration given the fact that a standard CTL plant produces about 2.5 times the carbon dioxide that a standard refinery puts out.

(http://research.investopedia.com/news/IA/2007/Coal-To-Oil_Americas_Energy_Solution_SSL_RTK_SYNM.aspx?ad=IA_RSS_762007).

Work done by CAENZ calculated, as a ballpark figure, the total CO_2 emissions from 'coal mine to wheel' per kilometre travelled at about 1.8 to 2.0 times that of emissions from 'oil well to wheel'. The emerging international experience with Carbon Capture and Sequestration (CSS) is indicating that price barriers may be much lower than many commentators believe. Solid Energy is currently undertaking extensive feasibility assessments of a possible future coal conversion plant based on the Mataura lignite fields. Indicative costs are in the $60 per barrel equivalent range making it competitive in the cost stack with other alternatives.

Dr Anthony Clemens identifies the role of lignites in a hydrogen energy economy, saying that lignites should have a crucial role to play in bringing security to the energy future of New Zealand. The resource is vast and they are suited for use in new high efficiency gasification technologies for production of hydrogen in a future hydrogen economy using standard petrochemical technology. In the shorter term they can be gasified to produce other products including electricity or synthetic fuels and chemicals. New Zealand's total lignite resources are a huge energy source – approximately 7 billion tonnes of known recoverable reserves with an energy equivalence more than 40 times that of the original Maui gasfield. Much of that resource is found in Southland, although the Otago deposits at Hawkdun, Home Hills, Roxburgh and Kaitangata are also significant. The lignites are extremely well suited to hydrogen production using technology based on one of the new advanced high efficiency clean coal gasification technologies. This hydrogen will be required to run fuel cell powered vehicles and for other applications in a future hydrogen-based energy economy. If there is a global shift to a hydrogen-based energy economy New Zealand therefore has some opportunity to follow the trend (http://www.caenz.com/archive/Lignite_Files/Clemens.pdf).

3.7 Towards Sustainable Transport – 2008 New Zealand Transport Strategy

There are formidable challenges facing the transport sector. It needs to find affordable ways to support the economic transformation of New Zealand and improve the health, safety, security and accessibility of New Zealanders, while at the same time addressing climate change and other environmental impacts. Business as usual will not lead us to where we want to be in 2040.

The Strategy provides direction for the transport sector over the next 30 years, in line with the government's sustainable development, energy and climate change agendas. It translates that direction into defined targets for the transport sector, sets out actions for achieving those targets and provides context for decisions about funding allocations. Work will continue with stakeholders to further refine these actions and targets over the next couple of years – any new developments will be included in future revisions of the Strategy.

Clearly Waitaki has an opportunity to embrace the strategy, plan for implementation, promote itself as a site for development of associated facilities (e.g. manufacture of electric car infrastructure components) and target an early share of funding allocations.

Over time, achieving the targets will result in a reduction of emissions because of an increase in the number of hybrid and full electric vehicles on our roads; more people using public transport, walking and cycling; and more transportation of freight by rail and sea. There will also be increased use of renewable fuels, more fuel-efficient technology and improved operating practices. Together these will help achieve the major goal to address climate change: to halve per capita domestic greenhouse gas emissions from transport by 2040.

Successful delivery of this Strategy requires

change, and the government is committed to working in partnership with local authorities, businesses and the broader community to deliver that change.

An example of State Highway traffic growth on SH1 at St Andrews is the 69% increase from 1990 to 2006.

(http://www.transport.govt.nz/assets/Downloads/NZTS-final-PDF.pdf).

Table 3.3 provides comparative data for the different transport modes. Rail travel is the most energy efficient on a passenger-km basis. Yet the most energy intensive modes, cars and domestic air travel comprise around 90% of both energy consumed and distance travelled.

Cars	Buses	Passenger Rail	Domestic Air	Total Travel
2.25	1.55	0.92	2.47	2.22

Table 3.3: Passenger energy intensity (MJ/p-km) by mode, 2006 (Source: EECA)

Table 3.4 offers comparative data for freight transport. Whilst road transport is not the most energy efficient mode for freight transport, it is, nevertheless, the dominant mode by which freight is moved.

Road	Frieght Rail	Coastal Shipping	Overall Freight
3.15	0.44	0.37	2.38

Table 3.4: Freight energy intensity (MJ/t-km) by mode, 2006 (Source: EECA)

3.7.1 Transport Fuels

3.7.1.1 Hydrogen

The 'hydrogen economy' has often been touted as the long-term replacement for an economy based on fossil fuels, with cars powered by hydrogen fuel cells being the transport component of this economy. However, there are many obstacles in the way of this vision becoming a reality. Hydrogen is an energy carrier rather than an energy source – in other words, energy from some other source must be used to make the hydrogen that powers the cars. Furthermore, fuel cell vehicles are not commercially available, and infrastructure to support their use would be difficult to implement in New Zealand. Hydrogen must rate as, at best, a long-term option only. New Zealand does not have nuclear energy able to produce hydrogen with off peak electricity. Significant investment in clean coal technology would be needed to produce hydrogen from our lignites and therefore development of such a facility will depend where scale places it on the technology cost stack. A move to a hydrogen based economy will result in continued dependence on off-shore energy and technology development and is therefore not an optimal strategy for New Zealand in the medium term.

(http://www.sef.org.nz/papers/peak_oil_land_transport.pdf).

3.7.1.2 Bio-diesel and Ethanol

There is considerable potential to use bio-diesel fuel as either a stand alone or supplementary fuel in vehicles and generators. Bio-diesel can be produced from a wide range of organic matter including plants, crops, effluent, algae, wastes and used cooking oil.

The potential of bio-diesel as a renewable energy source is considerable and is being rapidly developed elsewhere in the world now that the cost is competitive at $60/oil barrel equivalent. However, careful consideration should be given to trade-offs between competing land use such as dairying, forestry, other food crops, urban expansion, water use implications, as well as CO_2 emissions associated with the production process.

Note that ethanol production is complementary with the use of grain for animal feed. Animals can't digest the cellulose component of grains that is used for fuel production. This can be processed out of the grain prior to feeding without detrimental degrading of the food value. The animals produce less waste and methane as a result. Currently almost all of New Zealand's ethanol for fuel blending is derived from whey with current production approximately 16-20 million litres/year.

Ethanol blends of up to 10% can be run in fuel injected petrol cars without mechanical modifications. However, it should be noted that internationally ethanol fuelled vehicles capable of running on 85% blends or greater are now being factory produced. In 2008, the New Zealand Government mandated the use of biofuels in the New Zealand transport fleet. Current New Zealand regulations allow for up

Biofuels: Promise or Fantasy?

by David Painter

Biofuels have had a lot of publicity recently. Some of it has been wrong. Oxfam's recent report concluded that biofuel policies deepen poverty and accelerate climate change. The Parliamentary Commissioner for the Environment said the Biofuels Bill should not proceed,but Air NZ intends to use 10% biofuel by 2013. Earthrace just broke the round-the-world powerboat record, publicising biofuel.

Confused? Here are some facts, fallacies and fantasies.

Fossil oil is biofuel. Fact. Fossil oil was formed by micoscopic marine organisms trapped in geologic formations millions of years ago and subjected to extreme heat and pressure. Other biofuels are recent. Fallacy. Rudolf Diesel ran his first engine in 1895 on peanut oil, and said in 1912 that such oils could become as important as petroleum and coal tar products. Henry Ford designed his Model T to run on a petrol-alcohol blend, "the fuel of the future".

Peak oil is here. Fact. Arguing when peak oil will occur or whether it has occurred is pointless. Cheap fossil oil is no more. World transport fuel problems will be solved by... hydrogen fuel cells, electric cars, 'water motors', etc. Some take too long to implement. Others violate science.High prices for fossil oil, economic problems and rationing will occur. Fact. A top USA analyst expects an oil-induced financial crisis about 2010 to 2015, which will last at least 10 or 12 years. US consumers will pay NZ$5.20 per litre at the pump. It will be more in New Zealand.

Biofuel production increases food prices. Fact and fallacy. This is fact for biofuel made from food crops (first generation) or on food production land. Second generation biofuels don't use edible crops. Biofuel production causes deforestation. Fact and fallacy. It is fact for biofuel made from non-forest crops such as babassu palm, which displaces forest as in South-East Asia, but not generally. Recent US and European Union biofuel policies increased food prices and deforestation. Fact. Over-enthusiastic politicians adopted biofuel-encouragement policies when only first-generation biofuels were available.

There are huge reserves of [...] to quickly replace fossil oil. [Insert] shale oil, tar sands, methane hydrates, etc. Fallacy. Peak oil is about volume, but also ease, cost and rate of recovery. Some reserves take more fossil energy to recover than new energy obtained, and not quickly. The best contribution to New Zealand's transport fuel challenge will be conservation. Fact. It means using cars less, public transport more, more fuel-efficient transport, alternative energy sources and appropriate urban design and infrastructure.

Biofuels increase fuel prices. Fallacy. Almost half of Brazil's vehicle fuel is sugar-cane bioethanol, which costs NZ$45 a barrel, while oil is NZ$180. The Gull Oil blend in New Zealand of 10% Fonterra bioethanol and petrol, costs slightly less than petrol. Fossil oil will increase. Biofuel will decrease with second-generation biofuels and scale economies. Government intervention is unnecessary; the market will provide. Fantasy. State organisations control much world oil production. Global oil companies still maximise profitsfrom selling fossil-oil products. They have no incentives to treat the small New Zealand market generously.

New Zealand has great renewable energy. Fact. We have a steep, wet, sunny, windy, fertile country and a long coastline. Transport fuel is a special, difficult case, needing high energy per volume, safety and affordability. Biofuels will ease the difficult readjustment from fossil oil plenty. NZ is active in biofuels research. Fact. The Government's main 2008 research round allocated 9%, or $40 million, of all contestable funding to biofuels research. The Biofuels Bill will make matters worse, affecting atmospheric carbon, deforestation, land use and food prices. Fallacy. The Bill now requires biofuels to meet "specified environmental or sustainability standards or specifications".

There is still much oil; high prices result from producers playing the market, oil companies profiteering and the actions of commodity speculators. Prices will fall and business will resume as usual. Fantasy. The first sentence is probably correct, but see the “peak oil” and “high prices” facts, and the “solved by” and “quickly replace” fallacies. Business as usual is a fantasy. Richard Branson’s Virgin Atlantic Airline was the first to fly with biofuel, on 24 February 2008. Fact and fantasy. A Virgin Atlantic Boeing 747-400 flew from London to Amsterdam that day. One of four fuel tanks contained a blend of 80% fossil-oil-derived fuel and 20% vegetal oil-derived fuel. So 5% of the fuel was biofuel, for a 400 km flight in an aircraft with a 14,000 km range.

Air NZ will this year become the first airline to test second-generation biofuel, made from jatropha nut oil. Not yet fact or fallacy. Air New Zealand requires future fuel to be: “environmentally sustainable and not compete with food; at least as good as today’s JetA; significantly cheaper than that and readily available.” This Boeing 747-400 flight will use oil from jatropha grown in South-East Africa or India. Will it really occur this year, go a reasonable distance with one engine running on 100% jatropha-derived fuel, satisfy the airline’s requirements and New Zealand’s expectations for sustainability and social effects?

New Zealand can produce rapeseed biodiesel, as in the European Union. Fact and fallacy. We can and are (Solid Energy subsidiary Biodiesel NZ), but should not. It is a first-generation feedstock that competes for arable land with food and could interfere with seed crops. New Zealand can produce sugar cane bioethanol, as in Brazil. Fallacy. New Zealand can not grow sugar cane. Using crops like sugar beet or sorghum would still compete with food production.

New Zealand can produce maize bioethanol, as in the US. Fact and fallacy. We can, but should not. It is energy inefficient and contributes to world-grain price increases. New Zealand can produce wasteland-willow bioethanol, and simultaneously save Lake Taupo from excess nutrients. Fact and fallacy. Cellulosic materials such as maize, need more energy for processing than sugary feedstocks.

Lignin materials, such as cane willow, need even more. New Zealand can produce useful biodiesel from waste cooking oil and tallow. Fallacy. Commercial New Zealand biodiesel production started this way. There is insufficient waste cooking oil to contribute significantly to fuel needs and better things to do with tallow, at better prices, as Environment Canterbury discovered in its biodiesel bus trial.

Biodiesel is just diesel, produced from crops and animals. Fallacy. Biodiesel is usually produced from vegetal or animal oils by base-catalysed transesterification, producing monoalkyl esters. It is an international specification fuel which can be blended with diesel or used straight in diesel engines, but it is not diesel. More biofuel can be produced from aquatic microalgae than from land-based crops occupying the same area. City sewage ponds can be used to grow the algae. Facts. Microalgae are phenomenal biomass producers. Compare rapeseed at 1200 litres of biodiesel per hectare a year, maize at 3000 litres of bioethanol, sugar cane at 6000 litres, and jatropha or babassu palm oil at about 2000 and 4500 litres of biodiesel, with pond-grown microalgae at more than 30 000 litres of oil.

New Zealand company Aquaflow Bionomic produced the world’s first biodiesel from wild algae in 2006. Fallacy. Christchurch’s Solvent Rescue produced biodiesel from sewage pond algae in 2003. It was probably done earlier in Japan, Israel or the US.

Oil like fossil oil can be produced synthetically. Fact. The Fischer-Tropsch process used by Germany in the 1939-1944 war to make oil from coal is still used in South Africa. For energy and carbon reasons it is not a good solution for New Zealand. Other options, including liquefaction of biomass, show great promise.

Round-the-world record-making 100% biodiesel powerboat Earthrace sourced enough fuel from body-fat liposuctioned from crew and volunteers to propel it for 15 km of its 24,000 km journey. Fact, but irrelevant. It illustrates one difficulty in basing serious discussion of biofuels in New Zealand's transport fuel future on over-hyped publicity in media-sized bites.

These are items I have reacted to in television, radio and print. Which are facts, fallacies or fantasies, and the comments, are my opinions. Biofuels are neither good nor bad. They have an important transitional role in New Zealand's transport fuel future.

Biofuel production can be good or bad; it is subject to commercial, regulatory and social pressures.

David Painter is a Christchurch consulting engineer and former university academic. He worked on biofuels from crops in the 1970s and 1980s, and has more recently been involved in oil from algae developments. This article originally appeared in the Christchurch Press and has been reproduced with permission of the author.

Car type	2009 costs	2030 costs
Compression ICE	$39,800	$48,600
Spark ICE	$57,800	$60,000
Battery Electric vehicle	$57,100	$27,400
Hydrogen Fuel Cell vehicle	$203,900	$27,800

Table 3.5: Comparison of 10 year total operating costs of different vehicle types[1]

to 10% ethanol blend with petrol and 5% biodiesel blends for retail purposes, although mandated levels are less.

It is also interesting to note that up until the 1930s New Zealand produced a significant proportion of its liquid fuels from sugar beet crops. The development of large-scale production and bulk shipping tankers made importation of oil more economic. This economic equation has changed recently.

(http://www.caenz.com/info/publications/nesletters/downloads/ID44.pdf).

3.7.2 Electric Vehicles

Substituting fossil fuels with electricity in the transport sector is considered a very likely scenario with the majority uncertainty being around how much substitution will take place and the timing.

For different vehicle types NIWA has estimated the cost of operation for 10 years including capital costs, fuel costs and a carbon cost of $50/ton. These total costs are listed below.

Electric vehicles use much less energy. As an example the Solar Taxi (www.Solartaxi.com) is reporting 8 kWh/100 km on its around the world journey (with Trailer). That is energy equivalent to 0.8 litres per 100 km in energy terms. One litre of petrol is approximately 10 kWh of energy. Electric motors are 80%-95% efficient. Internal combustion engines in cars only achieve about 13%-20% (average 17%) efficiency and so most of the energy never gets to turn the wheels. It is wasted as heat.

Electric cars will soon be seen more often on New Zealand roads. Examples:

- Hyundai has announced a projected sales base of 200 plus vehicles per annum. The cars for sale will be a fully electric, plug-in version of the Getz. As an electric car the Getz will have zero emissions. The Getz is a retro-fit electric car, meaning that the batteries and electric motor are fitted to the car after the petrol engine is taken out. This process will be undertaken in New Zealand. The electric Getz has a top speed of 120 km/h with a range of 120 km on a single charge with a fast charge extending the range for a day's running to approximately 200 km (http://www.scoop.co.nz/stories/BU0809/S00534.htm).

1 See NIWA, 2008. *New Zealand's EnergyScape*. Presentation 16 July 2008 by Rilke de Vos. Available from: http://www.niwascience.co.nz/ncces/projects/energyscape

- Major car manufacturers are ramping up production of electric vehicles, with many set for commercial release within months. The challenge for New Zealand is to get cars in the face of overwhelming international demand. Demand has far exceeded supply of the vehicles. New Zealand's largely renewable electricity sources make it an attractive proposition for companies entering the electric car market. Meridian Energy plans a deal with a Japanese car manufacturer to introduce a small fleet of electric vehicles for trial and promotion purposes.
- In the USA, Chrysler LLC announced that the Company and its ENVI organization have new production-intent, advanced electric-drive technology packaged in three different vehicles – one for each of its brands, Chrysler, Jeep® and Dodge. Chrysler will select one electric-drive model to be produced in 2010 for consumers in North American markets, and European markets after 2010. Additionally, approximately 100 Chrysler electric vehicles will be on the road in government, business, utility and Chrysler development fleets in 2009.
- Now on the road in Christchurch is a second-hand Chinese-made Pioneer EV. This three-wheel electric ute is classified as a motorcycle, not a car, with registration only about $100 a year. It costs about $1 a day to run and is powered by six 100-amp hour batteries, drawing 72 volts which is enough to drive about 25 km after a six-hour charge. With battery technology improving its range should expand. Top speed is 65 km/h. New cost is about $12,000, but the demo model cost $8000.
- One internationally renowned electric vehicle expert says New Zealand should look closer to home for its future fleet, and believes we could be mass-producing our own cars by 2015. Waikato University professor Mike Duke says small, two-person cars could be built here and sold for as little as $10,000 each (http://www.stuff.co.nz/4690959a11.html).

Lithium-ion cells are poised to take an increasing share of the auto battery market, just as electric drive seems set to begin a long, slow climb to become, at last, a serious power-train option.

Even if electric vehicles gained a 60 per cent market share by 2040, they would use only 15 per cent of current power demand. Because most would be recharged overnight in off-peak periods, they would give generators confidence to build more variable-supply windfarms and may even help to reduce electricity tariffs. A good strategy for New Zealand is for all-electric cars to have the option of PV panels at home for charging.

(http://www.celsias.com/article/coming-energy-shift-update)

3.7.3 Coastal shipping

There is a coastal freight 'highway' that is freely available around the country. As a freight highway it is dependable and poses no threat to motorists, cyclists, pedestrians, or to the environment at large. Best of all, it requires no investment to acquire or improve and is already serviced by a network of well-equipped and self-sustaining ports.

This highway is capable of carrying unlimited amounts of freight the length and breadth of the country, and doing so far more energy efficiently than roads or railway. A tonne of freight moving on it uses just 15 per cent of the fuel consumed by a heavy truck and 60 per cent of that of a diesel locomotive over a given distance. Yet the sizeable economic and environmental benefits of this freely available highway resource have been and continue to be grossly under-utilised. The business of coastal shipping has not, and does not, receive a cent. Domestic freight volumes are set to double within 15 years and it is not credible that already congested main roads and under-resourced rail will be able to cope. Nor can New Zealand afford the huge capital investments needed to bring road and rail networks up to the required standard to handle such growth. (http://www.nzherald.co.nz/section/466/story.cfm?c_id=466&objectid=10509883)

Sea Change is a government strategy setting out proposed actions to help industry and government transform the domestic sea freight sector so that it can play its part in the overall transportation system. The aim of *Sea Change* is for coastal shipping to make a major contribution in managing future freight growth. Total freight movements are expected to more than double by 2040, putting huge pressure on the transportation system. Shipping has a vital

role to play in meeting this expected growth in freight movement, and is a key part of an integrated transport network. *Sea Change* is supported by government funding for investment in port facilities.

What is possible for Oamaru? Holcim has named PrimePort in Timaru as the preferred port to distribute cement when production is started. Cement is planned to be railed from Weston to Timaru.

The hurdle for potential users like Holcim is being the sole user and therefore the sole investor in establishing new facilities and/or developing existing facilities that have been neglected for an extended period. Their project already has high capital funding requirements for investment more directly related to their core business. An economic case could be developed to accommodate them if another party undertook the capital development and shared the facilities across a number of users.

Having the facilities established would be expected to attract other users such as a bigger fishing fleet (perhaps relocating from Timaru to allow that port to expand international shipping), facilities to service oil and gas exploration, return of shipping such as fuel delivery (with its advantage of increasing strategic local reserves), and costal shipping. Oamaru has recently fielded a request regarding a costal trader.

Since the Harbour Board was disestablished in 1978 only small fishing boats, pleasure craft and the occasional navy patrol boat have visited. With little money coming in, the council has struggled to maintain facilities. However, there are provisions in the 2008-09 Annual Plan to dredge the harbour entrance, proceed with the Harbourside Redevelopment Plan, and to undertake structural maintenance of the Oamaru Harbour Breakwater.

The District Plan itself has objectives and policies that recognise the Oamaru Harbour as being the only strategic opportunity for re-establishing a commercial port operation and the community wish that permitted use as port be maintained. The port is located in a strategic location from the perspective of pipelines and/or transportation links with the St Bathans Coal field in the Hawkdun Ranges and the off-shore gas fields.

The harbourside is also the location of the district's fuel storage and handling facilities. Originally fuel was delivered by ship tankers and had significantly more strategic storage. Oamaru is now serviced from Dunedin via road transport with an obvious increase in its vulnerability to fuel delivery disruption. Fuel stations have less than 3 days storage and the main highway can be closed for periods longer than that during normal winter conditions.

If a small port operation is to be re-established then provisions will be needed to accommodate supporting infrastructure such as warehousing, handling facilities, power supply, and fuel handling (http://www.waitaki.govt.nz/Council/Annual+Plan.htm).

3.7.4 Rail services - Strategic rail links - Main South Line

Main north-south rail link and alternatives to State Highway 1.

Waitaki District has a functioning railway line running through it and 41% of New Zealand's population has access to suitable rail connections. On a tonnage basis, it is estimated that approximately 13% of New Zealand's land freight is transported by rail (21% on tonne kilometre basis). Based on three rail growth scenarios, it is estimated that a 3%-7% share of the current road freight task is currently contestable by rail. It would be unlikely that rail could transport more than 20% of the current task without revolutionary changes to the way freight is transported. However, some recent rail initiatives such as the Fonterra dry storage facility in Hamilton, indicates that rail can have a significant effect on regional freight transport in specific cases (http://www.nzcid.org.nz/downloads/TRENZ%20(2006)%20Contestability%20between%20road%20and%20rail%20report.pdf).

Sunday, 10 February 2002 was the last day of the Southerner train between Christchurch and Invercargill, with sold-out trains operating in both directions that day. A study of the train service showed existing passenger numbers were inadequate. Of the push to re-establish the 'Southerner' – "I believe it would be worth doing a business case to see if such a service

would be viable." Taieri Gorge Railway operations manager Grant Craig was pleased people were thinking about rail. "I think people would definitely come back to the train if it was there," he said (ODT Friday, 5 September 2008).

New Zealand Railways Corporation (trading as ONTRACK) confirmed its Notice of Requirement for a designation for the 'Waiareka Rail Line' subject to noise conditions, on 4 July 2008 – this is for the planned transport of cement from Holcim at Weston.

Oamaru is a recognised quality tourism destination for rail excursions operating out of Dunedin. A day excursion train operation is an economic opportunity for the district.

3.7.5 Airports

Similar to the harbour, the Oamaru Airport was closed to scheduled air flights for a period of over 10 years. A daily service to Christchurch has now been re-established and is well patronised.

The airport does not have adequate fuel storage and handling facilities, which results in frequent replacement of flights with a bus service if there is a risk of fog. WDC is currently planning to enhance these facilities to overcome the issue.

The district is serviced by another airport at Omarama. This site is a world class gliding facility and has undergone significant development over the past 10 years as a specialized tourism venture.

3.7.6 Public Transport

The District has no public transport system servicing out lying rural townships with a connection to Oamaru and the elderly within Oamaru. This is despite the fact that school bus services are run extensively through the district and a rail system passes through all the coastal townships. In earlier times a rail car ran a service from Dunedin.

Some of the larger industrial sites contribute to energy sustainability by promoting a reduction in their combined employees' vehicle trips.

4 CONSTRAINTS & VULNERABILITY

Figure 4.1, from the Christchurch City Council Energy Strategy, indicates some of the inter-relationships involved.

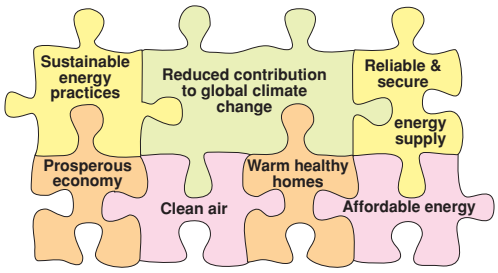

Figure 4.1: Constraints and vulnerabilities interrelationships (Source: www.ccc.govt.nz/environment/sustainableenergy/energystrategy.pdf)

4.1 National Level Policies and Strategies

4.1.1 Sustainability objectives: Towards zero carbon – the path to sustainability

Building a sustainable future makes good economic and environmental sense. Reducing waste and encouraging innovation and efficiency saves resources and money.

The government is spearheading this change by developing a range of programmes and policies to encourage change.

- Households: Energywise Homes and Smarter Homes help homeowners cut energy and heating costs. Other campaigns (such as www.sustainability.govt.nz and www.reducerubbish.govt.nz) target household waste.
- Vehicles: Fuel$aver and new emissions standards will improve fuel efficiency. Biofuel sales targets will cut overall greenhouse emissions.
- Buses and trains: Initiatives to encourage public transport use under-pinned by $900 million investment in infrastructure.
- Forests and sustainable land management: Programmes to encourage permanent tree planting and afforestation.
- Research funding: For industry and agriculture to seed environmentally friendly technologies that cut overall sector gas emissions.
- Business energy efficiency grants: A raft of programmes and grants to promote sustainable business and energy efficient technologies like solar heating.
- Public Service: Under the Govt3 programme government departments are getting their own house in order – aiming for a carbon neutral public service, focusing on recycling/waste minimisation, buildings, transport, office consumables and equipment.

These programmes are being accessed typically at regional council level. The best strategy for smaller communities might be to link in with existing programmes. (www.climatechange.govt.nz/nz-solutions/path-to-sustainability.shtml)

4.1.2 Climate Change

An emissions trading scheme (ETS) is a way to put a price on carbon so that industries that produce greenhouse gases, like carbon dioxide, pay a price based on how much they emit. This cost should encourage them to find more efficient ways of doing business. This in turn will help us reduces the damage that all countries are doing to the atmosphere and reduce the risk of dangerous climate change, as well as promoting a clean energy economy.

The New Zealand ETS is quite similar to the one in Europe and similar to those proposed in Australia and California. It sets up a market for carbon similar to the stock exchange so people can trade carbon they save with the carbon pollution caused by other people. It also makes exceptions for some industries which have to compete with overseas firms with no pollution control. These come in the form of tradable credits that can be bought and sold on the market. Gradually those exemptions will be phased out and everyone has to pay the full cost of their emissions.

We need to kick the carbon habit with real emission reductions and a transition to a low carbon economy. We believe we owe it to our children and grandchildren to act now, and if

More Kiwis to benefit from warmer, drier homes

17 October 2008

Middle-income Kiwi homeowners can now get more money from the government to help them invest in warmer, drier, more energy efficient homes, and more New Zealand householders are now eligible to receive this funding, Energy Minister David Parker and Government Spokesperson for Energy Efficiency and Conservation Jeanette Fitzsimons announced today.

Middle-income New Zealanders can now apply for a bigger grant towards insulation, clean heating and other energy efficiency measures for their house. The grant is one-third of the cost of improvements, capped at $1125 (incl GST). In addition, inadequately insulated houses built before 1 January 2000 (instead of 1978) are now eligible for funding under the ENERGYWISE™ programme. "People are healthier when they live in warm, dry homes. For every dollar spent on insulating cold houses, there is close to a two dollar benefit in energy and health savings. And this means less time off work, less time off school and a better quality of life," Jeanette Fitzsimons said.

The ENERGYWISE™ programme also offers funding for homeowners on a low income, and landlords with low-income tenants. "The ENERGYWISE™ programme provides funding to homeowners depending on need. For example, if someone is on a low income, and has health problems, they could qualify to have their house insulated for no, or very little cost," David Parker said.

David Parker said the ENERGYWISE™ home programme was part of the government's ongoing commitment to improve the energy efficiency of New Zealand homes. "The increased grants are from existing funding. In addition, we have announced a $1 billion Household Fund to further fund warmer, drier homes over the next 15 years."

Further information about ENERGYWISE™ funding and how to apply, can be found at www.energywise.govt.nz or call 0800 749 782.

all countries work together we can address this global challenge (http://www.greens.org.nz/node/19642).

4.1.3 New Zealand Energy Strategy to 2050 – Powering Our Future

The New Zealand Energy Strategy (NZES Oct 2007) sets out the government's vision for a sustainable, low emissions energy system and the actions that will be taken to make this vision a reality. The NZES is in two parts.

Part 1 sets out the government's vision for a sustainable energy system and the key actions we can take now to move us towards making New Zealand the world's first truly sustainable nation.

Part 2 gives details of the initiatives the government will take, both now and in the future. The relevant issues and the actions to be taken in each area are discussed under the chapter headings:

- Resilient, low carbon transport.
- Security of electricity supply.
- Low emissions power and heat.
- Using energy more efficiently.
- Sustainable energy technologies and innovation.
- Affordability and wellbeing.

(http://www.beehive.govt.nz/?q=node/30956)

This Energy Sustainability Plan is a first step for Waitaki in responding to the Government's policy lead.

Looking to the longer term the government, through the Energy Strategy, is working to diversify the sources of our country's energy supply. The government sees wind and geothermal energy providing significant new generation capacity in the future. Already nearly 750 megawatts of geothermal or wind energy generation are under construction, or have received planning consent. Consent applications for another 1700 megawatts of wind generation have been lodged. The

government wants additional energy generation to be renewable, except where security of supply needs dictate otherwise (www.med.govt.nz/templates/MultipageDocumentPage_32072.aspx).

4.1.4 New Zealand Energy Efficiency and Conservation Strategy

The government's detailed policies and actions on energy efficiency and renewables are set out in the New Zealand Energy Efficiency and Conservation Strategy (NZEECS), led by the Energy Efficiency and Conservation Authority (EECA). NZEECS is an action plan to:

- promote sustainability as part of New Zealand's national identity;
- improve the quality of life for New Zealand families; and
- drive economic transformation in business.

It is an action plan for many of the programmes in the New Zealand Energy Strategy and its programmes are complementary to the Emissions Trading Scheme in achieving emissions reductions. The NZEEC targets actions in five areas:

- energywise homes;
- energywise business;
- energywise transport;
- New Zealand's efficient and renewable electricity system; and
- government leading the way.

Specific issues for Waitaki to address are:

- older housing stock;
- high dependence on log burners;
- poor insulation levels; and
- businesses also have older facilities, low tech, poor efficiency, etc.

4.2 Electricity - Policy and Planning Principles

4.2.1 Regulatory Risk

4.2.1.1 Pricing controls

Electricity Line companies are subject to pricing controls regulated by the Commerce Commission. There are several elements to this control:

- Firstly, price rises are constrained to a CPI-X formula meaning that prices cannot be increased above inflation and real prices in fact must fall. The starting price was set at 2004 levels and X factor is reset every 5 years. Each company's starting price was different with no attempt to normalise. Therefore even within a region different line companies will have different allowable price paths.
- There is limited scope to increase prices to raise revenue for capital upgrades of infrastructure. This disadvantages companies which had low pricing and small upgrade programs.
- Determination of each company's X factor is related to their cost service position. Companies can trigger a Commerce Commission investigation into their pricing if their reliability of performance deteriorates. Again, there has been no normalisation so that companies which had a good 5 year average performance and low level of planned outages because of light work programmes, are disadvantaged when the drivers change. The statistics are not normalised and they are suitable as a comparator between networks only as a trend indicator within a network.
- A particular issue for local companies is that they design and maintain to more robust, but costly standards, and are subject to more frequent and extreme environmental events because of the scale of the landscape.
- Line companies pass through transmission costs to retailers and are required to return any transmission cost savings they achieve to consumers. This policy assumes Transpower is sole provider and sole option for delivering transmission solutions. This is not case and modernisation of the energy supply with DG, etc. will provide alternative solutions for lower cost transmission upgrade or avoidance altogether.
- Line companies are disincentivised to seek optimal least, cost solution for consumers and are not allowed to pass through the associated costs and share the benefits of their efforts.
- Asset Management Plans are also regulated. Line companies must disclose what they expect to spend on network development and maintenance and justify that expenditure in terms of service delivered

and wanted by consumers. They must justify any difference between what they actually spent, and what they stated they needed.

- They are also discouraged from taking a longer than 10-year view on requirements for excess capacity when planning upgrades to prevent 'gold plating'. Depending on the asset, its life cycle and growth rates, 10 years may not be an optimal provision.

The Ministry of Economic Development regulates legislation governing a requirement to offer residential consumers a low fixed charge component tariff. The breakeven point between normal tariffs and low fixed charge tariffs is 9000 kWh p.a. Low fixed charges do not match line company cost structures, which have high fixed costs. The outcome is to override all other recognised pricing principles, such as efficient pricing signals, elimination of cross-subsidy between load groups, etc.

In the Waitaki District this equates to approximately 80% of all residential supplies. This is a significant distortion resulting in a shift to average costing at the expense of efficiency signals. No account is taken of the fact that some houses are not electrically heated and have multiple energy options, i.e. low electricity consumption does not equate to efficiency.

In short, electricity pricing is inconsistent and conflicts with pricing objectives. This will not change until prescribed pricing methodologies are introduced as they have been for Transpower.

Modernisation of the electricity network with increased DG and bi-directional net power flows in effect make pricing based on energy volume unsustainable. In this scenario the services a network provides are dominated by volume delivery and distribution. The pricing structure becomes completely unrelated to service and costs.

4.2.1.2 Year 2013

Existing legislation only requires line companies to supply consumers until 2013. There is concern that this will result in mass disconnection of uneconomic supplies in 2013. This is unlikely to happen for the following reasons:

- The last segment of the supply is owned by the consumer. Any economic decision to abandon supply will more than likely be taken by the consumer of their own volition in order to avoid the cost of maintaining and upgrading their own assets.
- The dominance of average pricing principles results in there being no shortfall in revenue required to maintain these supplies. Line companies are not likely to make their assets redundant in order to reduce their revenues.
- The issue at the local level is what level of cross-subsidisation is to be tolerated in the absence of economic efficiency. Too much subsidisation can present uncompetitive pricing to the economy.

4.2.1.3 Line Losses

Line companies have an obligation with respect to efficiency and managing line losses. There are no prescribed standards or methodologies in this regard.

Currently line companies can simply guess at their line losses and this is passed through to consumers, i.e. there is no incentive or penalty for loss management.

Losses are not an easy issue to manage and need to be addressed on a case-by-case basis. Standards cannot be defined in a deterministic manner with any rational economic justification. Economically it may be a better to pay for the high losses of a long, low-revenue generating line than to pay the capital cost of upgrading it.

What matters in this debate is what level of overall losses are acceptable before competitive position is lost relative to neighbouring economies.

Nevertheless, the Electricity Commission is in the process of developing governance rules requiring network companies to calculate (no methodology prescribed) and publish technical line losses.

4.2.1.4 Service Standards

As discussed above, line company service performance is not consistent between companies. Different networks will also have differing reliability targets and different security standards.

In the Waitaki area performance is generally above national average even though load density has a rural bias. This is a strength the

region can use to compete and promote itself.

Coordination at a regional level might provide a marketing point of difference for attracting economic development. Specific locations can be tailored to specific industry requirements. This would require a solution overcoming the present mindset.

4.2.2 Electricity Vulnerabilities

Dry Year Risk

The 2008 dry autumn/winter has highlighted a security of supply issue not previously experienced. That is, management of storage against national conditions has resulted in local issues. SI resources were applied to the national situation and then when that situation ended the SI was left to deal with its own worsened situation.

The security of supply risk is not a risk that the power supply will actually be turned off. It is in fact a supply pricing risk. Power cost becomes very volatile and beyond the economy's ability to manage and so industry production is reduced.

In a region like the Waitaki, with its huge quantity of energy resources, this scenario never needs to happen. There is an argument for locally managing the region's security of supply. This may reduce exposure to the price path that will result from responding to risk at a national level. It may also give the region a competitive advantage in attracting new industry.

Climate change forecasts indicate that the Waitaki will become dryer relative to other parts of the country. Storage, in terms of snow fall, will reduce. Disparity to the national situation will worsen. Developing some diversity in the form of non-hydro generation would be prudent as would demand side responses such as the ability the switch on standby DG or aggregation of interruptible load.

4.3 Electricity Constraints - District and Regional Plans

4.3.1 Utility Access

The existing Waitaki District Plan specifies a number of voltage, capacity and height restrictions on the construction of power lines as permitted activity that are inconsistent with each other and present unintended obstacles to development.

It should be noted that the District Plans and Regional Plans are not consistent with regards to the rules for utilities. Some attempt to rationalise should be considered.

The following improvements are suggested:

- It is clearly desirable to locate utility services in road reserves rather than across private property where they may interfere with land owner's permitted activities. Road reserves should have their designations reinforced for this purpose. Access across private land cannot be guaranteed as conflict with irrigation, etc., is now becoming an issue.
- NZ Transit is becoming increasingly intolerant of power line location along state highways. This is an issue because state highways often present the only contiguous main route through a district. Districts with less roading infrastructure development in the first instance and those where road widening programs are being undertaken, will face high costs to develop their electricity supply accordingly.
- Oamaru is bisected by both SHW 1 and the Main South Line railway. Crossing rail reserves with power lines is proving difficult to achieve on acceptable terms and too time consuming to meet practical development timetables. Options need to be preconsidered and provided for.
- Policies with regard to undergrounding of powerlines through rural townships need to consider undesirable engineering implications of mixing overhead rural and underground urban power system designs. Where the scenario is not 'green-field', but paving, curbing, roads and driveways already exist, retro-undergrounding is very expensive relative to existing development status.
- Undergrounding of high voltage lines at 11 kV, with cables intended to deliver mainline capacity, is expensive. Undergrounding of sub-transmission lines is prohibitively expensive.

  A compromise would be to allow over-build of existing lines with higher voltages, but require the undergrounding of the lower

voltage circuit to maintain the same number of existing overhead circuits. This will result in cleaner structures without so many laterals, fewer conductors, and larger pole spacings, i.e. a significant visual improvement.

- In particular, an option for building 33 kV sub-transmission through urban areas is needed to allow for new zone substation development.
- 110 kV pole lines should be included in the permitted category. This is the existing transmission standard for the local supply whereas the core grid has a 220 kV standard. 110 kV pole lines require a 17 m height standard to clear roads and to cross lower voltage distribution lines. The restriction in urban areas is currently 12 m.
- Tree planting of species that grow above 4 m in height, beneath or within 10 m of a power line should not be a permitted activity. Managing vegetation clearances to power lines is a cost to everybody one way or another.
- Distribution substation sites (ground mounted transformers and switching stations) are restricted to 10 m^2. This encourages less desirable outcomes in an effort to overcome development rules such as not screening installations.

4.3.2 Transmission Corridors

In order to protect potential development options the following transmission routes should be designated as such, well in advance of any risk that they will become built out by competing use:

- From the Transpower Livingston Substation to the Oamaru Substation – a development option for reinforcing North Otago's main point of supply.
- From Pukeuri to Kurow Zone Substations – a south bank option following SHW 83.
- From Black Pt to Ngapara.
- From Kurow into the Hakataramea Valley and potentially through to Waimate.
- From Stonewall to Waimate and Studholm.
- From the Rox-Liv 220 kV line to the Kakanui Ranges – wind farm option.
- From Oamaru to Palmerston.
- From Palmerston to Naseby.

4.3.3 Electricity Governance (Connection of Distributed Generation) Regulations 2007

The government's overall objective for the electricity industry is to ensure electricity is delivered in an efficient, fair, reliable and environmentally sustainable manner to all classes of consumer. One specific outcome is to ensure that the use of new electricity technologies and renewables and distributed generation is facilitated and that generators using these approaches do not face unnecessary barriers.

The Electricity Governance (Connection of Distributed Generation) Regulations 2007 were made under section 172D(1)(10). The purpose of these regulations is to enable connection of distributed generation where connection is consistent with connection and operation standards.

The regulations specify processes (including timeframes) under which generators may apply to distributors for approval to connect distributed generation (including the information to be exchanged and the criteria for approval); regulated terms that apply to the connection of distributed generation in the absences of contractually agreed terms; pricing principles to be applied for the purposes of the regulations; and a default dispute resolution process for disputes relating to the regulations.

(http://www.med.govt.nz/templates/ContentTopicSummary–3847.aspx)

4.4 Infrastructure Vulnerability

4.4.1 Climate effects on Infrastructure – Waitaki District Examples in 2007

As a reminder of the need for infrastructure to be resilient to natural climatic events, the following are examples of events located in or near the Waitaki District, just for 2007. These are not the extreme events that will occur from time to time.

- **Snow.** Notable snowfall occurred on relatively few occasions in 2007. The worst snowfall occurred over 20–25 June to low levels in Southland, Otago, and the South

Island high country. In Central Otago cars were abandoned and a student died when the car she was a passenger in slid off the road. On 4 September, snowfall occurred to low levels in the east of the South Island, settling in low-lying parts of Canterbury (6–8 cm), with several schools closed. Minor stock losses of newborn lambs occurred.

- **Wind.** In October 2007, high winds from the west and northwest were frequent, with numerous widespread records of gusts over 100 km/h. Damage and disruption occurred throughout New Zealand, and included cancelled flights, fallen trees, toppled vehicles, and numerous incidences of damage to buildings and communications structures.
- **Flood.** A state of civil emergency was declared in South Canterbury and Otago on 30 July 2007 because of heavy rainfall. Roads were flooded and people evacuated from their homes. SH1 was closed both north and south of Dunedin. Rainfall exceeded 100 mm at several recording sites in the North Otago, Dunedin, and Taieri districts (http://www.naturalhazards.net.nz/__data/assets/pdf_file/0020/70454/nh_07.pdf). The insurance industry is particularly concerned about the number of homes and businesses that are situated in flood plains. The Insurance Council, along with other interest groups, has been working with the Ministry for the Environment to develop tools for local authorities to control development in flood plain areas. The sustainability of insuring property in flood-prone areas is a current concern (http://www.mfe.govt.nz/issues/land/natural-hazard-mgmt/flood-risk-review.html).
- **Storm surge, wind & waves – coastal erosion.** Storms during June and July 2007 caused damage to property and infrastructure in Southland and Otago. In Southland, erosion damaged a coastal road, and in Otago, storm conditions caused localised erosion along the northern part of Oamaru and a factory was destroyed as a result.
- **Tsunami.** On 16 August 2007, a tsunami was caused by a magnitude 8.0 earthquake off the coast south of Lima, Peru. The first waves reached the Chatham Islands 14 hours later, with a peak wave of 0.46 m. The highest wave (0.54 m) was recorded at Sumner Head, Christchurch, 20 hours after the earthquake. The ORC is investigating tsunami scenarios for the Otago coastline.
- **Earthquake.** In 2007 a magnitude 4.1 earthquake, 10 km deep and centred 20 km southeast of Dunedin, was felt throughout eastern Otago. New Zealand's tectonic plates move roughly 2 to 3 centimetres a year – the rate at which a person's fingernails grow. [McVerry, GH, Beetham, RD, Stirling, MW and Stephenson, WR, 2007. *Earthquake spectra and potential geotechnical hazards for Benmore switchyards*, GNS Science Consultancy Report 2007/240. ix, 62 p].

  The next earthquake centred on the Alpine Fault should begin in South Westland and will probably have a magnitude of 8+. This will be considered a 'great earthquake', not simply a strong one. The force will result in a horizontal earth shift of up to 8 metres, and a vertical displacement of 4 metres. The effects will be worst in West Otago, diminishing eastward. It is probable that the earthquake will occur in the next 1-20 years (http://www.orc.govt.nz/Portal.asp?nextscreenid=201.102.101.101&categoryid=1170&sessionx=DB15F2D1-7C25-4476-BE3C-F9ADEF575783).
- **Landslide:** 11,000,000 cubic metres is the volume of debris that would fill 370,000 truck-and-trailer units, and the size of the Young River landslide in the Southern Alps, August 2007.
- **Drought:** Severe soil moisture deficits (more than 130 mm) persisted from November through December 2007 in Marlborough, Canterbury, and North and Central Otago (http://www.naturalhazards.net.nz/__data/assets/pdf_file/0020/70454/nh_07.pdf).
- **Fire.** Eric Spital is the Emergency Services Manager for the Waitaki District Council and oversees Waitaki's Rural Fire Service: "We have had some huge fires in the winter time. Alternatively in summer, a green covering on the land can be deceptive with fine dry material building up underneath creating a potential fire risk. While we have strips of irrigated land, Waitaki also has plenty of gorse and forest areas. In the last financial year rural fires cost Council more than $600,000, most of which we were able to recover from insurance."
- **Temperatures:** Extremely warm conditions with maximum temperatures of 30°C or more occurred in many eastern regions

during 20–26th November 2007. In 2007, numerous inland South Island locations recorded minimum air temperatures below –10.0°C at times between 7–22 July. The severe frosts were often accompanied by freezing fog and treacherous black ice. Many household water pipes burst in South Canterbury, Otago and Southland following severe frost over 8–9 July and caused claims totalling $7 million.

4.4.2 Climate Change Planning

Predictions include a drier climate towards the east of the Waitaki Dristrict (North Otago specifically), and a sea level rise. These changes will have a negative impact on local production. It should be noted however that the rest of the Otago Region will experience warmer and wetter conditions, resulting in more favourable growing conditions. Consequently, it may not be in the Waitaki's interest to be reliant on ORC planning for climate change as their current mindset welcomes the possibility.

Sea levels are most likely to rise 30 cm to 50 cm by 2100. Sea levels around New Zealand have already shown a rise (14 cm to 17 cm in the 20th century). This rise is projected to accelerate coastal erosion, inundation, flooding from storms, salinisation of freshwater and drainage problems. The ORC plans high precision surveying of the entire Otago coastline to provide information on which areas may be affected by storm surge and future sea level rise. New coastal management policy indicates the need for local authorities to increase development setbacks in their plans to allow for increased storm surge (http://www.mfe.govt.nz/publications/climate/local-communities-planning-may04/local-community-planning-change.html).

For the Waitaki Council, this means the effects of climate change should be factored into long-term emergency and hazard management planning, land-use planning, and whenever council is considering new infrastructure and assets with a lifetime of more than 30 years. Of particular importance are:

- stormwater system capacity and design;
- water use rights and irrigation scheme placement and design ;
- development decisions relating to areas prone to river and sea flooding;
- decisions relating to housing and infrastructure in areas prone to coastal erosion; and
- land-use decisions, including those affecting management options for native ecosystems.

Address to the Hampden Energy Future Forum, 6.45pm, 31 October,2006 Hampden, Otago (http://www.beehive.govt.nz/node/27571)

4.4.3 Key facilities

Hospitals: for its population Oamaru has a relatively modern, well-equipped and sizeable hospital. It has geriatric, maternity and day surgery capacity. Emergency services rely on evacuation, by helicopter, to Dunedin. Timaru also has a larger hospital within 1 hours drive from Oamaru.

The hospital however is located below the 20 m Tsunami flood plane. It has standby generation facilities, but no water supply or sewer contingencies.

Petrol stations: are vital in an emergency response scenario to fuel response vehicles and machinery. No emergency fuel storage exists in the District. Petrol stations cannot function without a power supply.

Airport: external Civil Defence responses may rely on the air force mobilising supplies and people into the District as bridges and roads may not be passable. Fuel storage, communications, and standby power facilities (and the ability to operate at night) are desirable at this location.

Bridges: frequently become impassable during floods and as a result of their approaches washing out. Snow can equally obstruct road access. In these circumstances response is limited to helicopter access and isolated communities need to fend for themselves with the resources they have on their side of the obstruction.

Schools and Community Halls: are an important provider of emergency accommodation, cooking facilities and ablutions during Civil Defence emergencies. These could be incorporated in the emergency response planning with regard to provisioning, communications and backup power provisions.

Water Supply: most of the District's water

supply schemes rely on pumping. None of these have backup power supply. Stock water is a major issue during draughts and snow. The district is therefore dependent on how much storage it has with the capability to gravity feed. Household rainwater collection and storage should be encouraged. Key facilities should have water tanks installed.

Sanitation: is a major issue during civil defence emergencies, particularly in areas of high population density. Sewer systems rely on pumping stations and, therefore, power supply.

Communications: these networks are also vulnerable to loss of power supply. The ability for the public to phone in information is lost within 8-12 hours. Communities can easily be isolated by snow for more than 3 days.

4.4.4 Transport

Fuel Supply: the district does not have local strategic reserves of transport fuels, gas, or even coal and wood. It is reliant on being supplied from Timaru and Dunedin via the roading network and existing stocks only cover normal operations for a few days. For the size of its population and the degree of vulnerability to being isolated by extreme weather events, Oamaru's Emergency Preparedness is limited.

Petrol Station Network: Over recent years there has been a sharp decline in the number of rural township petrol stations. The community is now very dependent on large international oil companies that have no interest nor accept any responsibility for the wider service needs of the community. This poses several sustainability issues for the community:

- Farming communities have to travel further to refuel.
- Stored reserves are reduced.
- Travelling into Central Otago, via any of the three mountain pass routes, from North Otago, outside business hours risks running out of fuel.
- Refuelling during emergency and Civil Defence responses can be hindered.

Localisation of food distribution: supermarkets have sufficient stock to supply the local population with 2-3 days of its food demand. Their distribution systems are not local and therefore road transport dependent. Opportunities to buy locally produced food are limited and therefore the food supply has a high number of unnecessary food miles associated with it. For a community located in a food producing region, a more sustainable food supply is clearly possible.

This issue is being responded to with community gardens and farmers market initiatives. Operators of the major food outlets need the option of stocking local produce.

4.5 Regional Level Policies and Strategies

4.5.1 Canterbury Regional Energy Strategy Project (CRESP)

The CRESP will enable the establishment a Regional Statement of Local Opportunities for energy planning in Canterbury; for example, through the designation of transmission corridors to realise local opportunities. The Statement will inform public debate on opportunities, fill gaps in national energy strategies as these apply to Canterbury and guide investment in energy initiatives within the region.

The project will also be followed through with a number of initiatives targeting energy efficiency, insulation, solar heating, etc. in which Waitaki can participate. Currently, with regard to energy issues, the project is Christchurch focussed. Some balance with other parts of the region, which in some cases have conflicting interests, is open to consideration. This is an important opportunity for the Waitaki to exercise because of the amount of effort already expended and the level of resourcing accessible at regional level.

(http://www.ecan.govt.nz/NR/rdonlyres/B1053167-E70D-4B59-A34D-9DB7D5B0380B/0/CRESP_Stage1ExecSummary.pdf)

This document is the Waitaki equivalent of the CRESP. As parts of the Waitaki are in the Canterbury Region then some of the content of this report should be incorporated into the CRESP. Further, the Waitaki could follow Canterbury's lead with the development of a local Statement of Opportunities.

4.5.2 Otago Region Energy Supply Vulnerabilities

The Otago Regional Council commissioned the following study *A High Level Assessment of the Risks and Vulnerabilities to Energy Supply in the Otago Region* in August 2006.

This study comments on a number issues relevant to this document. The Otago study is centred on their major population centres at Dunedin and Central Otago, which have different geographic and demographic character to the Waitaki. The Otago region also has a number energy efficiency initiatives in progress that the Waitaki community can participate in.

For example:

- The Otago Warm Homes Clean Heat Clean Air Programme has three year contracts for funding from EECA. Waitaki District and Queenstown Lakes District Councils, which had not initially contributed to the project, have attended a recent governance group meeting and it is hoped that they will join the programme. In terms of insulation and retrofit programmes in New Zealand, the Otago project had outperformed in terms of goals and expectations. This is an opportunity for Waitaki.
- Pellet fires are being promoted more now that the establishment of a pellet factory at Tapanui has reduced the cost of the pellets, and the fact that pellet fires are being produced with ignition battery back up removes another hurdle to the uptake of this technology.
- There is a new $1 billion fund over 15 years, managed by EECA, for household investment in energy efficiency, such as improved insulation. The fund will be set in legislation with appropriations being required as the money is to be spent.

(*A High Level Assessment of the Risks and Vulnerabilities to Energy Supply in the Otago Region*, CAENZ, 2006)

4.5.2.1 Air Quality Constraints

Oamaru and Palmerston are in Air Zone 2, for the Domestic Heating Appliance Discharge Standards, which require less than 1.5 g/kg of fuel burnt for installations from 14 April 2007. The National Environmental Standard (NES) requires the average daily PM10 level not exceed 50 mcg per cubic metre in a 24-hour period more than once a year by 2013. As reported in Section 2.6.1, the ORC website reports that there have been 3 high pollution days in Oamaru for part of the winter, since 1 July 2008 (see Figure 2.2).

The standard allows security for heating and self sufficiency in the event of the failure of the power supply. Within Air Zone 2, the PM10 discharge standard for newly installed domestic heating appliances remains unchanged, and existing appliances will continue to be able to be used for the remainder of their useful lives. A new policy has been introduced to promote the use of clean heating in areas of new residential development.

Solid fuel heating in existing housing is at present essential for many reasons – poor house thermal insulation, cheap wood supply and energy poverty. The risk is that the existing older heating appliances, that pollute and do not comply with discharge standards, will be required to be replaced at an unknown future date. How is the "end of their useful life" to be determined? Will the rules change? Burning appropriate wood for heating is a sustainable process.

(http://www.orc.govt.nz/Documents/ContentDocuments/env_management/air/Proposed_Plan_Change_2/change_to_air_plan_dec_07/Summary%20of%20Main%20Changes.pdf).

Supply Chain Component	Hazard	Vulnerability	Consequence* (+ effects)
Electricity Supply	Weather Events - Snow - Flooding	Low security standards leave rural connections exposed to longer duration outages	Moderate
	Man-made Hazards - fire - accidental loss	Low security levels and limited interconnection at subtransmission level creates high risk of disruption	Low
	Capacity constraints - increased demand from irrigation, intensive farming - demographic shifts to Central Otago and coastal settlements - changing load patterns, eg uptake of heat pumps	Lack of coordination at the regional level. Incumbent line companies using historical trends Summer peaks dominating and increasing load factors	Severe
	Regulatory Frameworks - investment criteria - planning policy limits	Individual users unable to support cost of upgrade investments, thereby limiting economic opportunity in defining essential works	Moderate
	Distributed Generation Connection - incremental upgrades limit connection - GIT does not support new transmission upgrades in the region	Significant upgrade to subtransmission required for DG connection deters investment The 110kV transmission system stretched, limited capacity for significant new loads limiting economic development opportunities	Severe
LPG Supply	Weather Events - Snow - Flooding	Extended distribution and supply reliant on specialist supply chain. Low levels of home storage and dependency on electricity will see supplies rapidly depleted	Low
	Man-made Hazards - accident - industrial dispute	Regional supply vulnerable to disruption of tanker deliveries and road transport. Late delivery will lead to wide-scale gas shortages	Moderate
Other Thermal Fuels	Environmental - Fuel switching from coal (and wood) to LPG - Conversion of new households to electricity - Public opposition to new LPG storage	Fuel switching and the uptake of new clean burning appliances, instant hot water etc., increases dependency on secure electricity supply	Moderate
Consumer Demand	Fuel Poverty - household energy costs >10% - transportation cost	- air quality regulations forcing formal fuels market, limiting access to "free" fuel - potential supply shortfalls and the requirement for upgrade at both transmission and distribution levels is seeing increasing electricity costs, and a greater proportion of households spending more than 10% of their income on home heating - A doubling of transport fuel prices, and the cost of petroleum fuels for direct use is making SI industry (inc. tourism) less competitive with NI and Australian counterparts	Low
Essential Services	- increasing electricity dependence	Increasing use of remote sensing, distributed control and ICT in our essential services results in increased dependency on a secure electrical supply	Low

* Consequence has not been quantified; instead an arbitrary scale from low through to severe has been attributed to industrial vulnerability. Further more detailed work and quantitative analysis is required before a formal risk management framework is possible.

Table 4.1: Identified energy supply vulnerabilities in Otago (Source: CAENZ)

5 OPPORTUNITIES & COMPETITIVE ADVANTAGE

5.1 Transition Community

The Waitaki community is currently engaged in a Transition Community initiative. This is a sustainability programme to shift life style towards a low energy future. It is being run by the Mechanical Engineering Department of the University of Canterbury and involves the Hampden Sustainable Energy Group and the North Otago Natural Heritage Society. The Waitaki District Council is also supporting this initiative.

This initiative is a forerunner to likely mass market trends such as residential solar water heating, connection of PV cells and a shift in the diversity of domestic appliances and energy sources.

To date the district has been lagging the mainstream in terms of EECA driven programmes to install solar HW, improve insulation, and implement other energy efficiency programmes. This means, in simple terms, the district is missing out of central government funding support.

Studies undertaken with the HSE members and the highlighted in the BRANZ HEEP study on Oamaru housing stock provide the following insights:

- Housing stock is older than average, poorly insulated, and under-heated for healthy living conditions.
- Newer housing has condensation issues that degrade healthy living conditions
- The population is aging, which increases heating requirements.
- Energy cost is becoming a major cost burden on fixed income households.
- Houses and appliances are also larger than most people require, which is largely a legacy to do with families growing up and leaving home.
- Log burners are still the dominant form of heating with heat pumps starting to displace this important diversity in energy source. Heat pumps also add to summer load as they are used for cooling.
- Wood dryness is an issue for air quality and efficiency.

Eco-housing has been slow to start in this region in part due to planning rules and lack of necessity. Oamaru stone houses are in fact relatively good structures to retrofit to eco-standards. Eco-housing trends themselves are not likely to be dramatic. Most of the housing stock that will be present in 2050 has already been built, but a significant number of new houses are scheduled to be built before 2050. Most of the technology that will be retrofitted already exists and is therefore economic. Its penetration will improve and costs decline.

5.2 Climate Change needs Housing Change

Houses which rely on fossil fuels have no place in new housing from a sustainability perspective.

What is required is good design to optimise the use of the sun and other free, natural forces. Passive solar design should be part of all new housing. This typically includes a simple shape, appropriate building orientation, most window areas north facing with solar access during winter and eaves overhanging to avoid summer overheating, the best thermal insulation (high R value) roof, walls, under floor, concrete floors (thermal mass exposed to solar gain), double glazing with low heat-conducting frames, more thermal mass in walls, etc. It is a challenge to effectively optimise all the variables. A smaller house built to a higher thermal standard may mean an unchanged construction budget and a significantly improved thermal comfort (better for health) and much reduced heating and cooling annual budget. It should not be necessary to artificially cool homes in the Waitaki if the building is appropriately designed.

Solar effective houses cannot be placed on unsuitable suburban sites. Their effectiveness relies on the main (long) facade facing within 30° of north. Estate planners need to become

conversant with solar needs, making it possible for house designers to site effective solar houses. The perpetuation of estate planning carried out without any consideration of solar fundamentals, is exacerbated by rises in land values, resulting in ever smaller, badly oriented, housing blocks. This should not be such an issue in the Waitaki District.

Large, existing evergreen trees in the wrong place make many sites unsuitable. If we wish to take effective advantage of solar gain then we must reconsider our tree preservation rules and lay down mandatory regulations for future tree planting. Designers and builders need a clear policy that enables them to balance the value to society of saving trees versus reducing pollution by installing photovoltaic panels and solar hot water absorbers on house roofs. Consideration in the planning rules needs to be given to trees that grow too large and significantly reduce solar access. A starting point may be the same recession planes that need to be satisfied for new buildings. There is a need for a process that avoids the need to go to court to get neighbouring trees cut back.

See http://www.anzses.org/files/CCNHC.pdf for more details of the Australian situation.

5.3 Potential Distributed Generation (DG) Resources

5.3.1 Water

Water is significant to the Waitaki from a local perspective for two main reasons:

- Firstly the Waitaki River represents one of the nation's highest volume rivers – the very reason it is applied to generating the run-of-river hydro generation backbone of the New Zealand electricity system.
- Secondly the surrounding farmland is very fertile, but dry and extremely drought prone, more so than in the Timaru and Dunedin areas to the north and south of its catchment that won't be so negatively affected by climate change.

There are now higher value uses of water, even for very high volume uses, than its traditional application to large-scale, core grid-connected generation.

Clearly the local community can create wealth by applying its water resources to its land resources. To do this it must compete for the water with the larger economies on either side and with SOE generation interests.

The Waitaki water resource is subject to its own specific RMA legislation called the Waitaki Water Allocation Plan. This plan provides a framework for allocation of water between competing interests while maintaining balance with the broader environmental considerations of the RMA.

It is still a 'first in-first served' arrangement so it is vital for the local community to have its strategies dependent on water well advanced relative to its competitors. Water allocation is dependent on whether it involves abstraction, its location, whether its use will be in or out of the Waitaki catchment, and whether it is used for multiple uses.

The water is, however, a limited resource for each application so developments that improve efficient use of water will become the norm in the future. The area is already seeing a shift from boarder dykes to spray irrigation. This is less water intensive, but more energy intensive.

One hundred percent water reliability will also come under pressure and therefore water harvesting will become more common. Again this involves more intensive energy use. Either electricity or wind energy can be used directly for this. Associated water storage and head development provides opportunity for integrating hydro-generation with irrigation infrastructure.

In terms of the Water Allocation Plan, if every irrigation scheme incorporated a generation element then the dual use would afford strategic advantage of priority use during low flows.

More intensive water use will clearly lead to more intensive energy use. Accordingly the ability to support irrigation development with power supply infrastructure is a key planning issue. Irrigation requires delivery of electricity into farmland not previously reticulated and at far higher capacities than the existing networks are designed to deliver.

A major change that has resulted from irrigation and dairy farming for local electricity

networks has been a shift from winter peaking to summer peaking at GXP level. This affects transmission pricing as it is diverse with the Lower South Island 100 regional peaks, i.e. there is a pricing advantage compared to winter peaking dominance of city supplies.

Variance in weather patterns and energy saving campaigns can shift peak periods significantly. Shoulder seasons can then become the peaking periods. Growth trends in appliances such as air conditioning are also changing traditional city consumption patterns.

5.3.2 Wind

North Otago has a very large site suitable for wind farm development on the Kakanui Ranges. The wind resource modelling undertaken by University of Canterbury for NWL shown in Figure 5.1 indicates the scale and quality of the resource.

This opportunity is larger than can be connected at distribution network level, but is relatively close to the Rox- Liv 220 kV transmission line which crosses the same range through Dansey's Pass. To realise this opportunity requires a portfolio of other generation such as hydro to secure supply when the wind is not blowing. Wind generation can add value to hydro generation in the reciprocal scenario. Large-scale hydro storage and/or irrigation would also allow value to be created during times of excess wind and hydro spill.

There is no provision in the District Plan to permit the construction of a suitable transmission line, i.e. it would be a non-permitted activity.

There are an equal number of large-scale hydro storage sites that can be developed in the district. In fact there is a wealth of diverse generating resources that would enable the community to supply all its own energy, secure that supply, derive more income from being a net exporter of energy (and retain the profits locally), and decouple itself from the rising electricity price path being delivered by the national system.

The issue that prevents this opportunity being developed is scale and local capital resources. If these opportunities are to be developed then the community needs to find a mechanism for securing a share of the benefits.

Wind is also viable at a smaller distributed generation scale, that is, small wind farms up

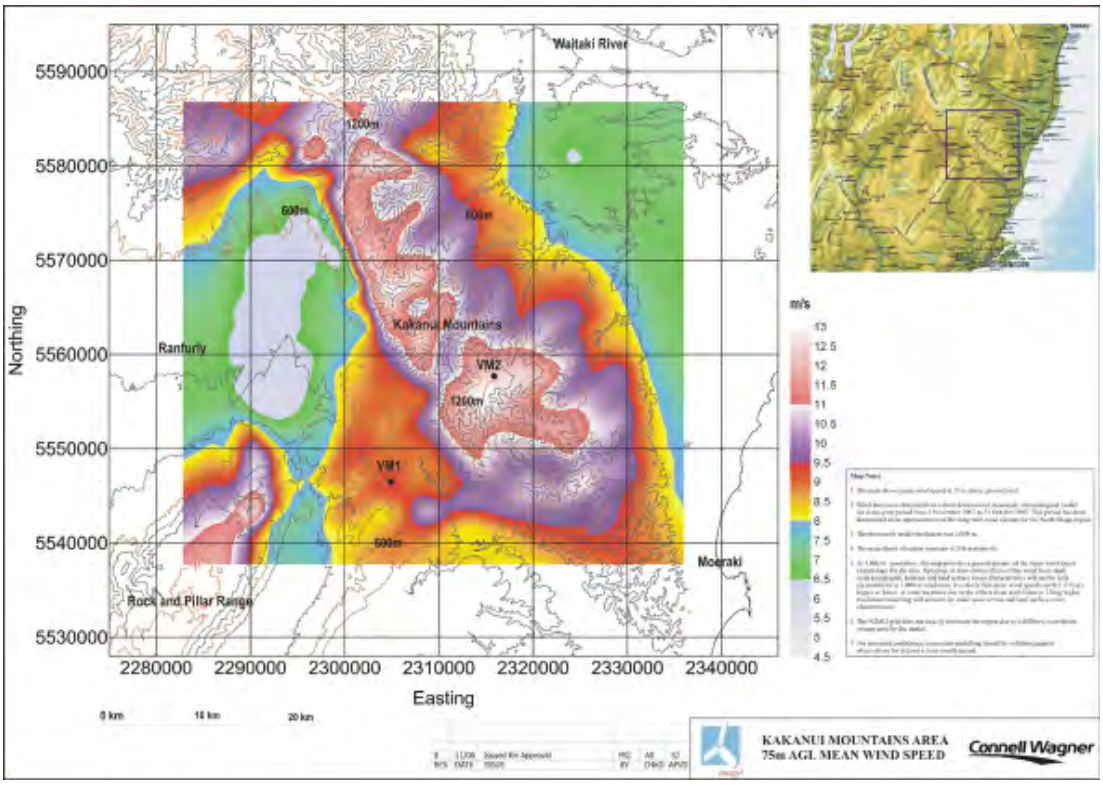

Figure 5.1: Scale and quality of the wind resource

to a few MW in capacity, with up to 3-4 turbines. Smaller scale wind farms allow lower quality wind resources to be used, which are located closer to existing electricity networks and so avoid the need for expensive network upgrades. Further the risk is lower and so less effort is required to monitor wind before development. Second hand wind turbines are readily available for this type of rapid implementation development.

A wind map, wind rose, and power density plot are shown in Figure 5.2 for such a typical site. The total number of these sites exceeds the need from local use perspective. Approximately 30 MW of wind generation is estimated to be adequate from an optimal system perspective.

This scale of development is well within the scope of farming business to fund and could be used in the future to off-set power charges. In this scenario the diversity in the load of the all consumers connected to the distribution system allows, in effect, surplus energy to stored and used later, i.e. only net flows flow in the distribution network. The more distributed generation connected to the network the lower the use of the transmission system and the cost for doing so.

If surplus generation eventually results into a net flow back into the transmission system then the system adds value to the energy being exported.

Currently, even such small-scale generation of any type is not a permitted activity in the Waitaki District Plan. This is perhaps more restrictive than it need be and a set of development rules within which such proposals must comply may remove the hurdle.

It is a fact that windy sites tend to be on hill tops where they are visible. The blanket nature of Significant Landscapes District Plan Changes is creating uncertainty with regard to where value judgements will rest and the cost of the consenting process. The community is still

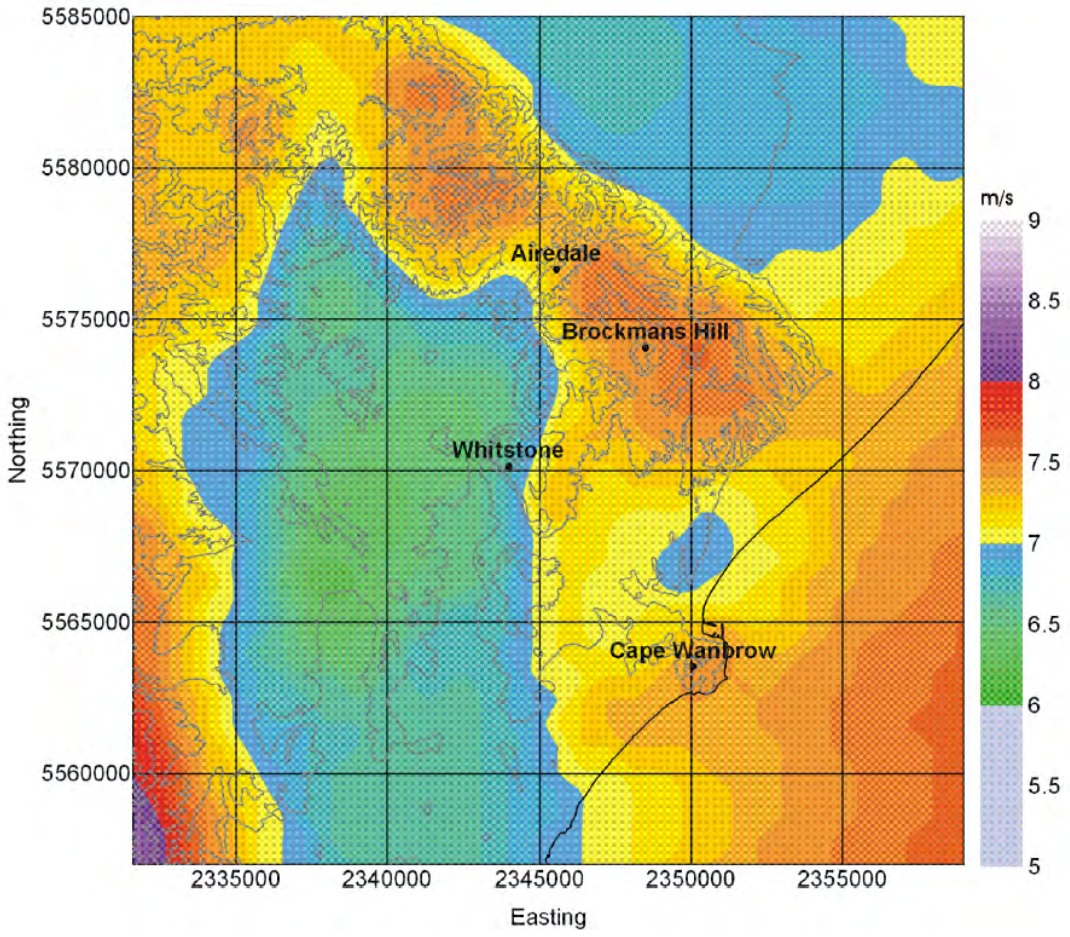

Figure 5.2: Wind map, wind rose, and power density plot

debating issues around landowners' rights and whether windmills alter the developed farmland character of sites.

5.4 Development of Resources

The community has investment options that can build energy resources to support sustainability into the future.

5.4.1 Wood

Planting of forests and coppices for timber, fuel, biomass (an alternative carbon source to fertilizer), and animal fodder has large number of environmental and sustainability benefits. These include:

- CO_2 sequesting.
- Dry land management and drought proofing.
- Flood protection and erosion control.
- Habitat building for wildlife.
- Environment enhancing for recreation and tourism.
- Fuel quality management for reducing log burner air pollution.
- Screening negative impacts of roading and traffic noise.
- Providing a barrier to dairy effluent and fertilizer entering water ways.

Table 2.3 indicates that planting has significantly reduced over the past five years.

The UK and Europe have had large forest and coppice restoration programmes in place for several decades now. This district can learn from the problems of intensive farming experienced elsewhere and take early mitigation steps to avoid them. At the same time it can build an energy resource and reduce the intensity of its water and electricity use.

A reoccurring request in Annual Plan submissions is the establishment of contiguous planted borders from mountains to sea along either side of all major water ways.

5.4.2 Coal Seam Gas (CSG)

New Zealand's largest lignite coal deposit lies under the Hawkdun Range between Otematata and St Bathans. Coal deposits contain methane gas which slowly leaks into the atmosphere. Methane is worse as a green house gas than the CO_2 produced by burning it. Consequently abstracting coal seam gas and using it for electricity generation is seen as a carbon neutral 'green' technology.

Such generation plants would complement the hydro and wind development in the South Island by providing firming capacity and emergency reserves. This in turn would reduce dependence on the North Island generation and the DC Link.

There are also a number of smaller coal deposits that might be suitable for DG-scale development.

Carbon geosequestration involves depositing carbon dioxide into the earth's crust, however, this is an unproven technology. With today's technology, carbon separation and geosequestration is likely to double power generation costs – a large proportion of the original energy in the coal is required.

5.4.3 Biomass

Crops and food are all energy sources. Effluent, waste and milk by-products can all be used to produce bio-fuels. Economics are shifting in favour of returning a significant proportion of land-based production back to energy production. This may bring some balance into the current trend towards dairying.

The NZES has targets for bio-fuel content in our transport fuels. North Otago is recognised as a highly productive grain growing region and there is an opportunity to build itself a niche in the national energy supply.

5.4.4 Tallow

The Pukeuri Freezing Works uses a very energy intensive wet rendering process. This has an advantage in that the tallow it produces is of high enough quality to be used for animal feed. This value proposition is currently changing and more efficient rendering processes are now available.

Tallow is an energy source that can be burned directly or used to produce bio-diesel. Producing bio-diesel locally reduces exposure to

external international pricing risks to which export businesses are particularly sensitive.

5.4.5 Hydro Storage

As recorded above, the region has many locations suitable for building large-scale hydro storage that can be applied to both irrigation and electricity security. Pumped storage to use excess energy should not be overlooked. Pumped storage is used when there is little control over the availability of generation, such as wind, or when base load generation has limited ability to back-off, such as thermal and nuclear plants. Pumping allows them the run at optimum level over night and the storage is used for peaking during the day.

6 WHAT CAN LOCAL GOVERNMENT DO?

6.1 National Policy Statement for Renewable Electricity Generation

Enabling identification of renewable electricity generation possibilities

Policy 4

By 13 March 2012, local authorities are to notify, in accordance with Schedule 1 of the Act, a plan change, proposed plan or variation to introduce objectives, policies and, where appropriate, methods, into policy statements and plans to enable activities associated with:

- The identification and assessment by generators of potential sites and energy sources for renewable electricity generation.
- research-scale investigation into emerging renewable electricity generation technologies and methods.
- Supporting small- and community-scale renewable electricity generation.

Policy 5

By 13 March 2012, local authorities are to notify, in accordance with Schedule 1 of the Act, a plan change, proposed plan or variation to introduce objectives, policies and, where appropriate, methods, into policy statements and plans to enable activities associated with the development and operation of small and community-scale distributed renewable electricity generation.

6.2 Support Community Energy Initiatives through Economic Development Strategies

Community energy, based on a mix of distributed technologies, offers a serious alternative to the current energy system. The nature of community energy and the role that such initiatives might play in the general fabric of civic life is not, however, well understood. Community energy initiatives might involve only those citizens who prefer to be actively and continuously involved in intense, democratic debate. A more robust conceptualisation of community energy might, on the other hand, be guided by Benjamin Barker's notion of 'strong democracy', in which community energy initiatives would draw upon a much broader citizen base, involving people from many walks of life and from quarters not generally presumed to be part of a sustained democratic process. There are problems, prospects, and limitations of a socially and technologically decentralised energy system.

This last paragraph is supported by the experience of the Hampden Sustainable Energy group. There is a wide diversity amongst energy users with regard to user preferences, the service levels they desire and what they are prepared to pay, and investment affordability. Consequently initiatives that require 100% buy-in and agreement of the fundamental performance standards are unlikely to progress. Programs need to offer a range of solutions for individuals to choose from and need to address the inherent inequities of people's circumstance.

6.3 Provide Leadership

Proactive adoption of policies and leading best practice with regard to:

- low Carbon futures;
- energy efficiency;
- sustainable buildings and operations; and
- Agenda 21 compliance

We need environmental leadership that acknowledges the importance of economic growth and least-cost solutions, and we need business and farming leadership that accepts the importance of good environmental management.

Holcim provides a fine example of a business that seeks to engage in collaborative relationships, and is committed to a vision of the future that embraces good economic, social and environmental outcomes. New Zealand – and the world – needs more of this kind of business leadership.

6.4 Address Planning Shortfalls

Specifically with regard to:

- What can and should be developed in which locations, based on community consensus.
- Standards and guidelines that steer uptake of sustainable options.
- Rules that permit development of required resources for desires activities.
- Rules that protect infrastructure development options.

7 CONCLUSIONS

The past cannot be sustained, we must adapt to a new situation. A temporary feast of non-renewable resources has enabled an unsustainable overshot of the demands we place on the planet. To reduce energy use, or to make the best use of what we have, we need to look at which technologies fit best with what we like to do and what resources we have on hand. Technical efficiency increases alone do not usually reduce overall consumption in the absence of other limiting factors. For example, adding insulation to under-heated homes will make homes more comfortable and healthy, but will not reduce energy use. Therefore, the task is to find which form of heating makes best use of resources on hand, and to provide feedback on consumption. Is increasing electricity use for space heating appropriate or should clean burning wood burners with potential to also heat water be encouraged? Are new domestic-sized wind turbines appropriate?

We can expect to see an increase in sustainability retrofits including heating, transport, high density housing and localisation of energy generation or community energy systems. The coming years will challenge us to use the combined strengths of individual, local community, government and world-wide grass roots organisations to create a change.

As top-down decision-making falters in the face of globalising forces and the complexity of the problems needing resolution, a need emerges for negotiation and consent across wide governance networks of stakeholding groups.

Local authorities have a key leadership role to fulfil. They need to engage and educate the community about the need for change and enrol local industry and businesses in the process of seeking a viable future in their own interests.

This document presents a broad content intended to inform the Waitaki community and present possibilities for a more sustainable future. What should and will be progressed is a matter for the community to determine. However, the following actions are recommended as key features of an Energy Sustainability Plan for the Waitaki.

Recommended Actions

- Engage the community in a planning exercise with regard to the location of residential, business, and industrial development, permitted activities in those locations, protection of amenity and development standards, giving specific consideration to environmental and sustainability issues. A well thought out plan reduces hurdles to consenting, public dissent, court battles, etc., and the planning process can be a community building exercise.
- Specifically consider the distribution of the population growth into rural townships and what is required to enhance the development of these communities as distinct from urban sprawl in larger population centres.
- Also consider the strategic merits of establishing serviced industry-ready sites and subdivisions.
- Support the above debate with development of a Sustainable Land Management policy.
- Proactively develop a Water Management Strategy that positions local interest ahead of competitors in terms of the Waitaki Water Allocation Plan.
- Fully develop an Agenda 21 compliant District Plan.
- Consider solutions to the community's vulnerabilities issues. A holistic approach favoured by sustainability philosophy will solve many of these issues.
- Specifically take into account the likely effects of climate change, the community's preparedness, and changes to development standards required to mitigate effects.
- Develop a Transportation Strategy that addresses public transport reducing private vehicle dependence.
- Protect the opportunity to reopen Oamaru harbour as a commercial port operation. Investigation into the merits of investing in strategic facilities such as ports, airports,

etc., should be undertaken by the Economic Development Unit.

- Update the District Plan accordingly, targeting coordination with other District Plans and Regional Plans.
- Incorporate rules and guidelines into the District Plan that encourage and support the uptake of eco-housing/buildings and services.
- Update the District Plan specifically to facilitate the development of local resources for distributed generation.
- Update the District Plan with regard to development rules for utility services.
- Consider designating access corridors for future likely utility development, protecting desired economic development and communicating intentions to affected parties well before the consenting process. This will reduce the consenting cost and timeline.
- Establish a distributed generation development programme amongst interested parties, possibly via a local generation company vehicle.
- Local line companies to consider the merits of joint ownership of a regional transmission company to capture control over the region's own transmission service provisions.
- As a local economic development unit initiative, investigate opportunities for water storage supporting both irrigation and electricity infrastructure.
- Refocus the Economic Development Plan on diversifying the district's strengths in secondary sector food processing.
- Provide support to local sustainability initiatives, such as the Transition Community project, with regard to:
  - Enrichment of the environment with woodland, copses, greenbelts, etc.
  - Management of firewood supply and quality.
  - Encouragement of community gardens and farmers markets.
  - Identification of feasibility of opportunities such as local bio-fuel production, coal gas, etc.
- Participate in EECA funded regional programmes with respect to solar energy, insulation upgrades, business energy efficiency, etc.
- Leading organisations to lead by example with respect to carbon neutrality and sustainable building/operations.
- NWL to develop contingencies for the uptake of mass market PV cell connection and electric vehicles.
- Align and adopt consistent policies with Government policy and strategy.

8 APPENDIX

8.1 Waitaki District Council District Wide Issues, Objectives and Policies

5 ENERGY

5.1 Resources, Activities and Values

Waitaki District, like the rest of the country, is largely reliant on non-renewable energy resources, such as oil, for carrying-out a wide range of activities throughout the District. This is particularly so in the area of transportation, industry and the use of mechanical equipment of farms.

The District does contain six hydro-electric power stations based on the renewable water resource of the Ohau and Waitaki River systems. By far the majority of this hydro generated electricity is exported from the District via the National Grid.

Most of New Zealand's increasing energy demand is currently being met by fossil fuels, oil, gas, and hydro-electricity. Although we have enough energy to meet our present needs, this will not necessarily be the case in the future. The fossil fuel resources used in New Zealand are finite. As their availability worldwide decreases and New Zealand uses up its own reserves, their cost will inevitably increase. Activities dependent on the use of fossil fuels will be vulnerable to their lack of availability and price rises. However, the likelihood of this causing difficulties for New Zealand in the foreseeable future will be affected by the extent of any new discoveries of fossil fuels in New Zealand and the extent to which alternative sources of renewable energy such as windpower become viable.

Energy consumption is an integral part of the functioning of the majority of activities in the District, which are dependent on the continuing availability of fossil fuels for transportation, manufacturing, processing, heating, farm and forestry production, amongst other activities. In New Zealand, the largest consumers of energy are industry, followed by transportation.

Demand for transportation energy is increasing and, like most industies, the transport sector is largely inflexible about the energy sources it uses.

Increasing emission of greenhouse gases into the atmosphere is being linked to global climatic changes. The two most significant greenhouse gases are carbon dioxide and methane. Most carbon dioxide emissions from human activities come from fossil fuel burning, particularly from transportation and electricity production in the large thermal power stations. Methane emissions are almost entirely from livestock, with a small proportion from landfills and fossil fuel use. Due to the complexity of the earth's biological and physical interrelation-ships, the effects of these on climate cannot be precisely predicted. However, the possible effects on New Zealand are:

- temperature rises;
- increased westerly winds;
- changes to rainfall patterns;
- increased likelihood of drought on the east coasts;
- sea level rises; and
- greater extremes in climatic events.

5.2 ISSUE 1 – Efficient Use

The conservation and efficient use of energy resources so that the adverse effects of energy production and use are avoided or mitigated and the needs of future generations can be met.

The Resource Management Act requires the Council to sustain the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations and to avoid adverse effects of activities on the environment. The Council must also have regard to the efficient use and development of natural and physical resources, including energy. Sustainable energy resources are likely to be important for the needs of future generations to be met.

The efficient use of energy resources now will

assist in making them last as long as possible, improve their availability for future generations, and allow time for the development of more sustainable, renewable energy sources. In recognition of the future costs and scarcity of energy resources and the environmental effects of energy use, there is an increasing awareness of the need for energy efficiency and conservation and the use of renewable energy resources, such as solar energy.

As existing energy resources in New Zealand reach their capacity and the limits of their reserves, there will be pressure for the exploration of new energy sources, such as the sites for the construction of new hydro-electricity stations. This can result in adverse effects on the environment such as loss of habitats, land and recreational resources.

Increasing car ownership and distances travelled are being recorded in New Zealand. The location of land use activities can directly influence the numbers and lengths of vehicle trips taken or the likelihood of public or shared transport being feasible, with a consequent effect on the amount of fossil transport fuels being consumed.

A reduction in the burning of fossil fuels has also been identified by the government as the most effective method of reducing greenhouse gas emissions. Local authorities can influence this reduction and lead by example through policies for the use of fuel in the Council's own vehicles, buildings and services, through its waste management policies and through community education.

The management of the country's energy resources is principally directed through government policy and may be the subject of national policy statements under the Act. However, the Council has a responsibility to address local energy issues and to adopt methods that will encourage increased efficiency in energy use, energy conservation and the use of renewable energy sources. The Council has limited powers to achieve this, but there are some methods which will assist, albeit to a small degree. The location and design of land uses can be important in reducing the numbers and lengths of vehicle trips or improving the accessibility of buildings to sunlight. Land use patterns can be developed over time that are amenable to new options of energy use in the future, such as increased use of public transportation systems.

5.2.1 Objective

The conservation and efficient use of energy within the Waitaki District.

5.2.2 Policies

1 To promote compact urban and peri-urban forms, which assists in reducing the length of and need for vehicle trips and increases the likelihood of the use of public or shared transport.

2 To promote the compact location of community, commercial, service and industrial activities within urban areas, which assists in reducing the length of and need for vehicle trips.

3 To require residential sites to be large enough to enable buildings to be constructed to take the greatest advantage of renewable solar energy for heating.

4 To control the location of buildings and outdoor living areas to reduce impediments to access to sunlight.

5 To promote increased awareness of the need for energy conservation and efficient use of energy resources.

6 To adopt fuel conservation strategies in relation to the design and operation of the Council's vehicles, buildings and public services.

7 To promote, through its waste management strategy, reductions in waste generation and efficient waste management techniques.

8 To encourage the retention of remaining areas of indigenous forest vegetation within the District and to limit restrictions affecting exotic forestry plantings to those necessary to avoid, remedy or mitigate adverse effects on the environment.

9 To recognise the existing Waitaki hydro-stations and to provide for their ongoing use.

10 To provide for the establishment, operation, maintenance, enhancement, upgrade, and development of electricity generating activities in the district while ensuring that adverse effects on the environment are avoided, remedied or mitigated.

5.2.3 Implementation Methods

To achieve policies 1 - 10 through:

1 Provision of rules to control site sizes for residential units, shading of adjoining properties and orientation of outdoor living areas.

2 Zoning and the delineation of defined zone boundaries to ensure compact urban and peri-urban forms and the compact location of community, commercial, service and industrial activities.

3 Allocating Council resources to:

   a) promote the dissemination of information regarding energy conservation, the efficient use of energy and waste reduction, in a form that can be understood and be useful to the community; and

   b) investigate and undertake improvements that can be made to the energy efficiency of the operation of the Council's vehicle fleet, building and service facilities.

4 The use of Scheduled Activities in the Rural S Zone to recognise the operation, maintenance and upgrade of the existing Waitaki hydro-scheme.

5.2.4 Explanation and Reasons

The Council has limited influence over the total consumption of energy resources within the District as the management of the country's energy resources is principally directed by national government policy. The Council can, however, play its part in assisting with public education and promotion regarding the long-term need for energy conservation and efficient use of energy resources.

The Council's main area of influence with respect to energy conservation relates to the location and design of land-use activities, subdivisions and buildings. The location of landuse activities relative to one another can be a significant determinant in the length and number of vehicle trips undertaken. Trips between home and work, school, community and commercial activities, for example, can be reduced if these activities are in close proximity to each other or at least grouped together. In a rural area, such as the Waitaki District, it is physically possible for activities to be spread over a large area of the District. The Council's policies seek to keep as compact a form as possible to the District's urban areas; to the location of those activities that need to cluster around the urban areas in the peri-urban area; and to the community and business centres within the District.

The location and design of sites and buildings can also assist in ensuring there are no impediments to access to solar energy. The size of sections created on subdivisions can ensure that there is ample space available on the site for the construction of a building that can take the greatest advantage of the available solar energy. Difficulties with the variable size and shape of existing sections and areas of land available for subdivision make it impracticable to require the design of subdivisions and buildings to achieve a prescribed orientation to the sun. However, guidelines will be used to provide information about the opportunities available.

The Council also has the ability to lead by example, being a major energy user within the District. Fuel efficiency by Council vehicles can be addressed through fuel type, vehicle size and maintenance. An energy management programme for Council-owned buildings could address matters such as insulation, heating, cooling and lighting levels, and the use of improved technology to reduce energy consumption. This could also include Council services, including street and recreational lighting, pumping systems and swimming pool operation.

Forests may be important 'sinks' which trap and breakdown greenhouse gases. Rural Districts, such as Waitaki are the most likely location for future carbon sinks. Through its policies, the Council seeks to remove any unnecessary hurdles to the planting of exotic forestry and to ensure that as much remaining indigenous forest as possible is retained.

Due to the significant contribution the Waitaki hydro-stations make to the overall hydroelectric power generation in New Zealand, it is appropriate that they be provided for so that they can continue to operate.

5.3 ISSUE 2 – Nuclear Power Generation

Environmental risk associated with nuclear

power generation.

Although the risk of nuclear power station accidents are very low the potential consequences could be enormous through radiation fall-out. In addition, the safe long-term disposal of radioactive waste is difficult and may pose a long-term threat to the environment.

5.3.1 Objective

Avoiding nuclear fission as a means of producing energy.

5.3.2 Policies

1 To prohibit nuclear power generation as a means of producing energy so that the potential for significant adverse effects is avoided.

5.3.3 Implementation Methods

To achieve policy through the provision of rules to prohibit nuclear power generation – refer to Chapter 16 Hazardous Substances.

5.3.4 Explanation and Reasons

Consistent with the Regional Policy Statement for the Otago Region, the establishment of nuclear power plants shall be prohibited.

5.4 Environmental Results Anticipated

- More efficient use of energy in the operation of the Council's vehicles, buildings and facilities.
- Progressively increasing efficiency in the use of energy for development and transportation.
- Progressive reduction in air pollution.
- Progressive reduction in carbon dioxide emissions.
- Minimising the need for, and travel distance of, vehicle trips.
- Reduction of waste being disposed of as a result of efficient waste management techniques.
- Avoidance of nuclear power generation.

http://www.waitaki.govt.nz/NR/rdonlyres/E8BB207D-D7E1-4092-BEFE-9AD6C3670E4E/26485/II_05EnergyOP.pdf, downloaded 16 Oct 2008

8.2 Waitaki Development Board Draft Strategic Plan 2008-2011

Vision

WDB will promote and facilitate business growth which sustains and advances the wellbeing of our vibrant community and the place in which we live.

Goals

For continuing, stable growth in our economy we need to have a spread of economic activity, together with a positive attitude in the community to that activity. Waitaki Development Board will focus on five primary economic development goals:

1 Irrigation – promote irrigation for a wider range of usage.

2 Industry – service existing businesses and attract new ones.

3 Tourism – develop attractions, increase services and grow the market.

4 Film – facilitate filming opportunities.

5 Attitude – celebrate successes to attract population and workforce.

Measuring Success

While the Board's specific performance will focus on the tasks defined below and how it achieves these, it will also have regard to wider economic indicators in the regional strategy. These wider regional economic indicators are provided through the annual BERL Economic Performance Report and by selected extracts from Statistics NZ. WDB Statement of Corporate Intent details the reporting requirements to WDC.

Goal 1: Irrigation

Irrigation is rapidly changing the Waitaki economy. Main application to date has been for dairying and this is expected to continue, however alternative uses need to be explored.

We need to promote our water resource for a wider range of usage, to assist in the expansion of identified irrigation schemes and promote strategic distribution of water to a wider area of the district.

Tasks

1.1 Assist NOIC and others to promote the expansion of irrigation schemes.
Measurement KPI: increase in hectare uptake; data from NOIC.

1.2 Promote and facilitate alternative development opportunities for farmers.
Measurement KPI: documented examples of other product.

1.3 Assist development in viticulture, intensive cropping and horticulture.
Measurement KPI: growth in vineyard output, data from WVWA growth in cropping quantity: data from M&W.

Goal 2: Business Development

To service existing businesses and grow new opportunities, we need to ensure they have the necessary resources, suitably zoned land, infrastructure and availability of a trained workforce.

Tasks

2.1 Support new industries and encourage existing businesses to grow.
Measurement KPI: examples of success.

2.2 Facilitate development of industrial land, to attract business.
Measurement KPI: extra zoned land; data from WDC.

2.3 Encourage downstream manufacturing from increased diversification of farming.
Measurement KPI: examples of success.

2.4 Retain air services from Oamaru.
Measurement KPI: flights frequency ex Oamaru.

2.5 Facilitate business training.
Measurement KPI: OCC workshops held.

Goal 3: Tourism

Tourism is a growing economic contributor to the district. It has high visibility, employs a number of people in a variety of activities and provides an opportunity for the community to positively promote the place in which we live. We have a shortage of 'export-ready' product so we need to develop more attractions, build additional accommodation and grow our share of the national and international market.

Tasks

3.1 Promote the region – rollout of *VisitOamaru* branding & collateral.
Measurement KPI: report on VisitOamaru rollout.

3.2 Encourage existing attractions to expand – OBPC, Vanished World, Totara Estate, etc.
Measurement KPI: report from OBPC, VW, others.

3.3 Help develop new attractions – Victorian Heritage, Historic Precinct, eco-tours.
Measurement KPI: report on new attractions.

3.4 Encourage service development – new hotel, motels, cafes, transport.
Measurement KPI: report on new accommodation, services.

3.5 Assist the Oamaru Opera House to attract conferences and conventions.
Measurement KPI: number of conferences booked.

GOAL 4: Film Industry

Lord of the Rings promoted New Zealand as an attractive location for international film-makers. In recent times *Perfect Creature*, *The Lion the Witch and the Wardrobe*, *Bride Flight* and the AMI and NetFlix commercials, to name but a few, gave popular attention to Waitaki and garnered the support of the local community.

The 10 year pan-Otago Economic Strategy put the film industry as one of its top five priorities. Film Otago Southland Trust Inc. has just been established with full support of Film New Zealand and participation by all Otago and Southland District Councils. Investment New Zealand is fully funding a feasibility study to evaluate a major film studio for the Southern New Zealand region.

Tasks

4.1 Achieve Film Friendly Status, produce Filming Guidelines & photo library.
Measurement KPI: status, guidelines & library achieved.

4.2 Actively participate in Film Otago Southland Trust.
Measurement KPI: annual report of FOST.

4.3 Promote Waitaki as a film location.
Measurement KPI: report on films made in Waitaki.

Goal 5: Create a Positive Attitude

Community support for economic growth is a core element in our ability to both retain

current population and workforce and to attract migration. By celebrating and promoting good news stories, we will portray our lifestyle and socio-economic activity in a very positive manner, which may attract others to visit, live and work here.

Tasks

5.1 Promote Waitaki – Regional Economic Profile, website, BERL reports.
Measurement KPI: regional profile, website.

5.2 Celebrate successes in the media – print media, radio.
Measurement KPI: copy of media articles.

5.3 Build networks – OCC, OSEA, Business Breakfast, Her Business network.
Measurement KPI: report on network participation.

5.4 Facilitate business cooperation, locally and regionally.
Measurement KPI: examples of cooperation documented.